MARVELS OF THE UNIVERSE
OR
WONDERS OF THE WORLD

Digitized by the Internet Archive
in 2025

https://archive.org/details/marvelsofunivers0000vari

TERRIBLE COMBAT WITH THE MONSTERS OF THE DEEP.

MARVELS OF THE UNIVERSE

OR

WONDERS OF THE WORLD

BEING

ACCOUNTS OF THRILLING ADVENTURES; FAMOUS SCENES; CELEBRATED VOYAGES AND RENOWNED EXPLORATIONS AND DISCOVERIES IN MANY PARTS OF THE GLOBE

CONTAINING

GRAPHIC DESCRIPTIONS OF THE WONDERS OF THE OCEAN AND OF THE ATMOSPHERE; THE SEA-GIRT ISLES OF THE PACIFIC; SUBTERRANEAN WONDERS; PECULIAR CHARACTERISTICS OF ANIMALS, BIRDS, AND INSECTS, ETC., ETC.

AMAZING PHENOMENA OF THE SOLAR AND STARRY SYSTEMS

EMBRACING

WORLD RENOWNED SIGHTS IN MANY LANDS

THE WHOLE FORMING

A VAST MUSEUM OF ALL THAT IS MARVELOUS AND WONDERFUL IN THE EARTH, SEA, AIR AND SKIES

By ALEXANDER P. LIVINGSTONE
The Well Known Author

Embellished with a Great Number of Superb Engravings, which Add Greatly to the Value of the Work

---

ENTERED ACCORDING TO ACT OF CONGRESS, IN THE YEAR 1910, BY GEO. W. BERTRON IN THE OFFICE OF THE LIBRARIAN OF CONGRESS, AT WASHINGTON, D. C.

PREFACE.

There was a time when men spoke of the Seven Wonders of the World, and these were celebrated in the finest productions of prose and poetry. That time has long since passed, and the number seven would now have to be multiplied many times to enumerate the Marvels of the World. To set these forth in attractive form is the object of this volume.

As might be expected, this book is very comprehensive. It is filled with Wonders brought to light by explorations in many countries. Almost every land beneath the sun presents us with something of Thrilling Interest. In all parts of the globe we have but to lift the veil of mystery to meet with revelations which excite our astonishment.

In this book the reader is made the traveler. He is transported from clime to clime, from country to country, and, through artistic illustrations and Picturesque Descriptions, becomes acquainted with the Marvelous.

The Ocean is fathomed, and whatever of special interest is to be found among its flowery growths, its strange fishes and buried treasures, is fully described and shown. Even subterranean mysteries are lighted by the torch of investigation. He is conducted through the sea-girt isles of the Pacific, and, while the scene changes at every step, the Wonders never cease. A book of mere commonplaces would have little interest for the general reader. The aim has been to make this volume true to its title. To realize that aim, the records of research and discovery have yielded their most valuable treasures.

The book vividly presents the Myriad Wonders of Natural History, etc. The Kingdom of Nature is explored and made to disclose its Marvelous Secrets. The Atmosphere contributes its snowy crystals, gorgeous pictures of the sun, cyclones and auroral splendors. The Animal Kingdom is also largely represented, and whatever is curious and interesting in animal life finds here a place. The most attractive specimens of Birds are described, and interesting lessons are drawn from the habits and instincts of the feathered tribes.

Special attention has been given to the minute forms of life, for these have the truly Marvelous wrapped up in them, as well as the planets and star-clusters of Astronomy. The Skies contribute their swift comets, meteoric showers, and wonders of infinite space. Search has been made for the Wonderful in every part of the Globe.

Special pains have been taken with the engravings contained in the book; and these, by their great variety and artistic merit, form a very striking and valuable feature.

CONTENTS.

CHAPTER I.

WONDERS OF THE OCEAN.

The Ocean a World in Itself—Wonderful Sea-Plants—Mermen and Maids—The Famous Nautilus—The Devil Fish—Immense Poulpe—Crabs that Seem to Reason—Nest-Building Fishes—Curious Barnacles—Sponges—The Saw-Fish—The Torpedo—Rainbow Beauty of the Sea—Colored Waters—The Flying-Fish—Dolphins—The Sea-Serpent—Ocean Flowers—Sea Anemones—A Crab with a Pack on his Back—The Wonderful Star-Fish—The Medusæ—The Coffre-Fish—Creatures in Armor—A Thieving Crab—Marvelous Corals—A Strange Fan—The Brain Stone—Singular Fishes—The Sea-Porcupine—A Fish that Travels on Land—Gems of the Ocean—The Gulf Stream—Bay of Naples and Vesuvius—Wonderful Depth—Sea Cucumber—Female Pirates—Strange Tales of the Ocean 17

CHAPTER II.

SUBTERRANEAN WONDERS.

The Inside World—The Earth a Mass of Fluid Crusted Over—Marvelous Caves—Bone Relics—The Famous Mammoth Cave—Mysterious Caverns—The Splendid Star-Chamber—A Cave with Human Bones—The Celebrated Luray—A Strange Bridal Chamber—Various Compartments—Astounding Limestone Formations—Exquisite Flowers in Stone—Fingal's Cave—Wonderful Coal-Beds—A Man Fifty Years in a Swedish Mine—Water Under Ground—Artesian Wells..... 62

CHAPTER III.

WONDERS OF THE PACIFIC ISLES.

New Zealand—Rare Products—Tattooing—Strange Customs—Reception of a King—Volcanoes and Boiling Springs—The Bread Tree—New Caledonia—Superstitions—Dances—Coral Islands—New Guinea—Description of the Natives—Savage Fijians—Island of Tahiti—Excitement over a Horse—Sandwich Islands—Volcanic Eruption—Captain Cook and His Death—Surf Swimming—Pitcairn's Island—Singular Monuments—Handsome Marquesians—Island of Java—Marvelous Natural Beauty—Volcano—Animal Life—A Gem Set in the Sea..... 80

CHAPTER IV.

WONDERS OF ASTRONOMY.

Our Sun One of the Stars Composing the Milky Way—Astronomy of the Ancients Very Crude—Fable, History, and the Animal Kingdom Furnish Names for the Constellations—Vulcan's Shield—Stars of Different Magnitudes—Constellations of Great Brilliancy—The Great Bear—Glowing Tribute of an American Poet—Little Bear—Pole-Star—The Pivot of the Sky—Cassiopeia—Andromeda—The Northern Crown—Stars Blue, Yellow, and Red—An Old Legend—Hair Transformed into a Constellation—Hunting Dogs—The Zodiac—The Ram—The Bull—

Famous Pleiades—The Twins—Cancer—The Lion—Scorpion—He-Goat —Aquarius—The Fishes—Old-Time Fancies—Renowned Orion..... 119

CHAPTER V.

WONDERS OF THE ATMOSPHERE.

A Storehouse of the Marvelous—No Such Thing as Cold—Beautiful Vapor Crystals—Gorgeous Pictures of the Sun—The Wonderful Mirage—Striking Effects of Frost—Aerial Navigation—The Great Voyage Across Europe—A World Far Below—The Balloon in Warfare—Despatch from a Balloon to President Lincoln—The Dreadful Cyclone—Theory of the Whirlwind—Trade Winds—Snow and Rain in Colors—A Rain of Ink—Marvelous Showers of Dust and Fishes—Brilliant Sunsets —The Barometer and Thermometer—Men Who Thought They Could Fly 137

CHAPTER VI.

WONDERS OF ANIMAL LIFE.

Thoughtful Provision for Animal Wants—Fur, Nails and Feathers—Beautiful Arabian Horses—War Chargers—Equine Intelligence—His Majesty King Leo—The Polar Reindeer—Great Irish Deer—The Musk Ox—The Yak—The Spry Syrian Goat—The Fleet Kangaroo—Wild Animals of the West—"The Ship of the Desert"—The Wild Ass—The Long-Clawed Aye-Aye—Sly Reynard—A Four-Footed Fisherman—The Jerboa —A Long-Nosed Animal—White Monkeys—The Odd Mandrill—White Elephants—The Elephant's Sagacity—The Huge Mammoth—A Gigantic Tortoise—Polar Bears—Grizzly Bear of California—The Seal—An Animal Charmed with Music—The Monstrous Sea-Horse—The Alligator —The Hard-Shelled Armadillo—A Wonderful Dog—Intelligent Cats— An Animal That Dies From Its Own Bite—Leeches in Ceylon—Darwin's Crab—Construction of Animals..... 167

CHAPTER VII.

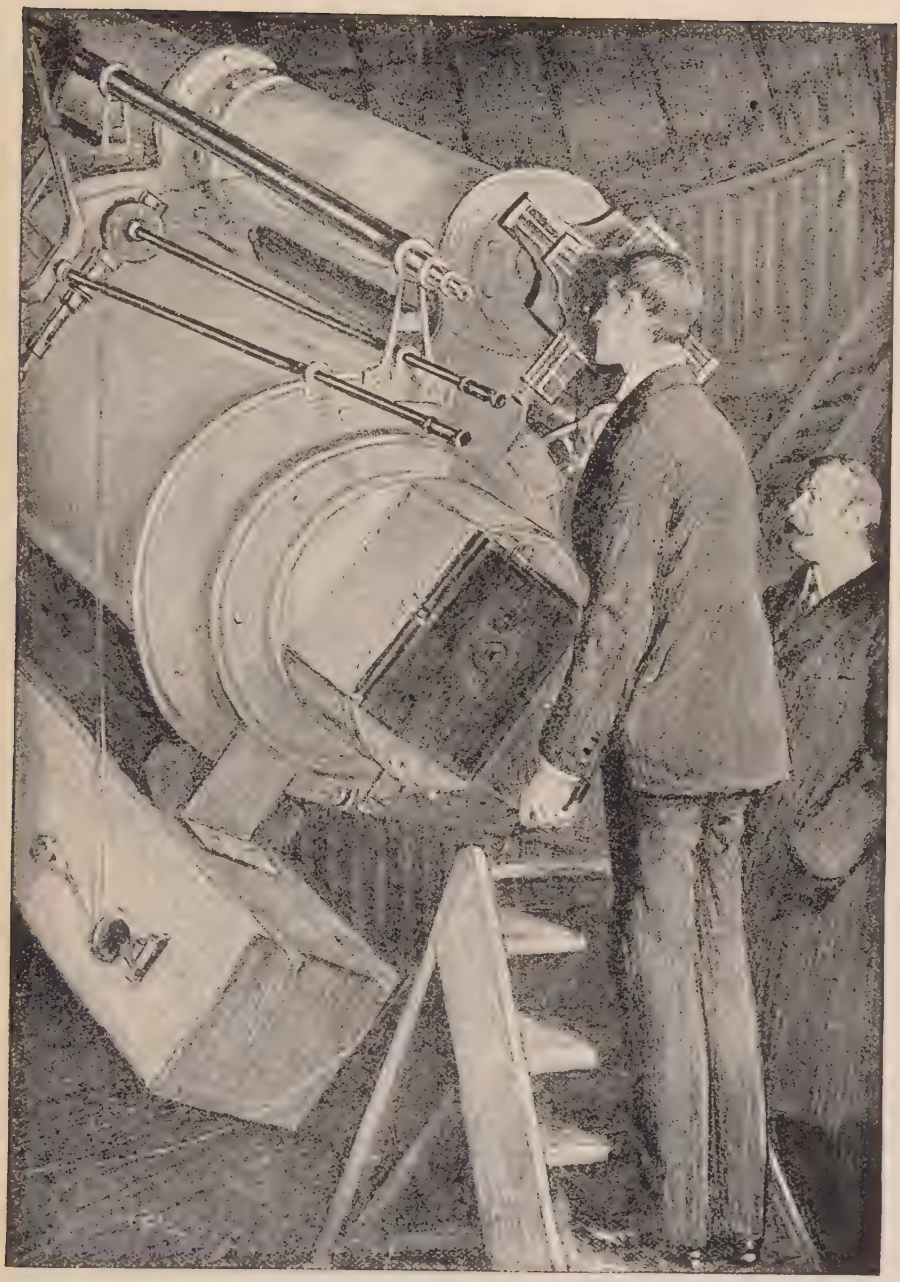
WONDERFUL BIRDS.

Enormous Birds of Ancient Time—The Condor—The Famous Dodo—Eagle and Fish-hawk—Rooks Holding a Convention—Wonderful Bird of Paradise—The Humming-Bird—The Curious Moth—A Bird that Rings a Bell—Ingenious Nests—The Flamingo—The Frigate Bird—Mysterious Butter Bird—The Hornbill—The King Penguin—Talking Birds—Parrots —The Handsome Hoopoe—The Cuckoo—The Pretty Fly-Catcher—The High-Flying Kite—The Lanner Falcon—The Java Bat—The Bittern— The Thrush—Nests that are Eaten—Turtle Dove—Ring Dove—The Marvelous Cockatoo—Interesting Lessons from Bird Life..... 214

CHAPTER VIII.

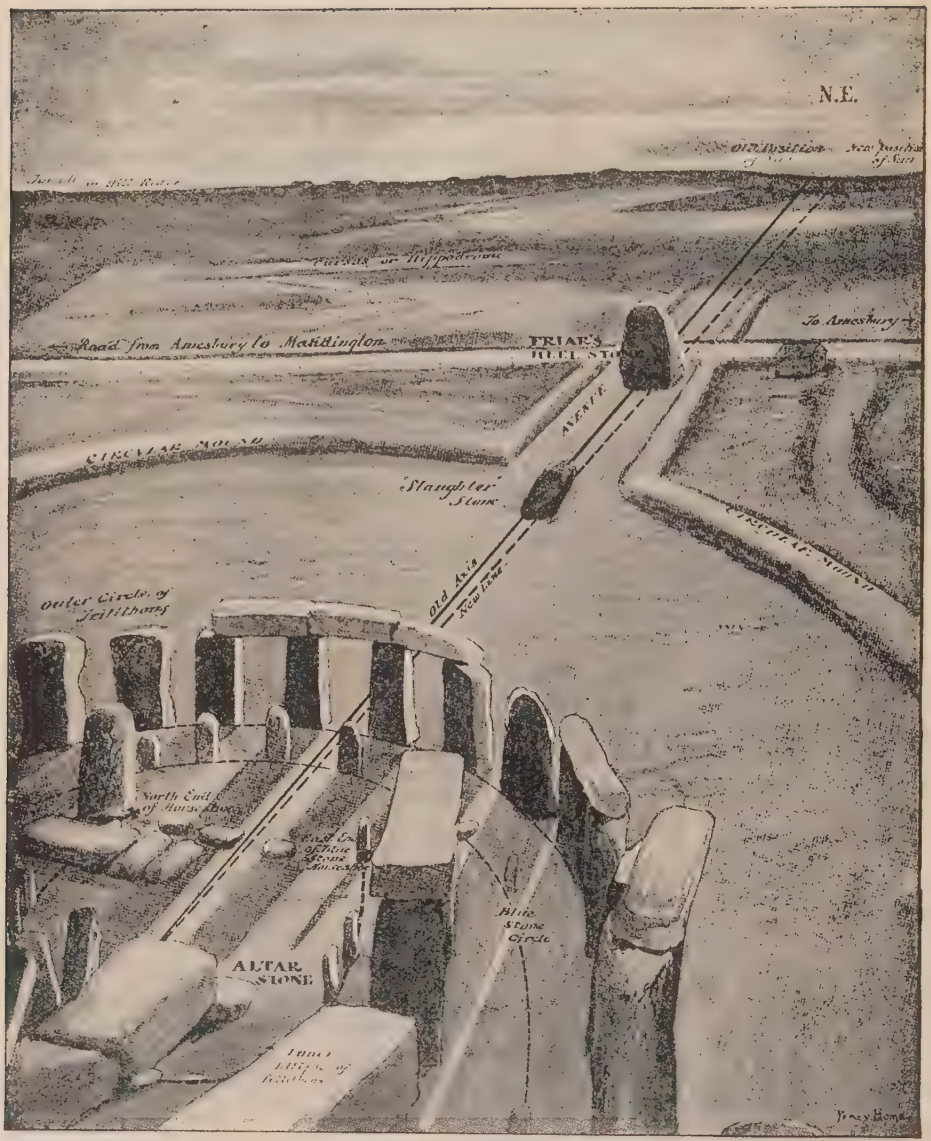
WONDERS OF THE INSECT WORLD.

Extraordinary Strength of Insects—Their Jumping Power—The Sprightly Flea—The White Ant—Ants' Intelligence—Insects that Keep a Dairy —The Brilliant Lantern-Fly—The Wonderful Bees—The Venomous Scorpion—The Ruinous Weevil—A Fly's Mouth—Butterfly Wonders.. 243



MAKING DISCOVERIES IN ASTRONOMY

THE MACHINE HERE PICTURED IS USED FOR PHOTOGRAPHING THE SUN AND STARS, THE OPERATOR IS IN THE ACT OF TAKING A PHOTOGRAPH



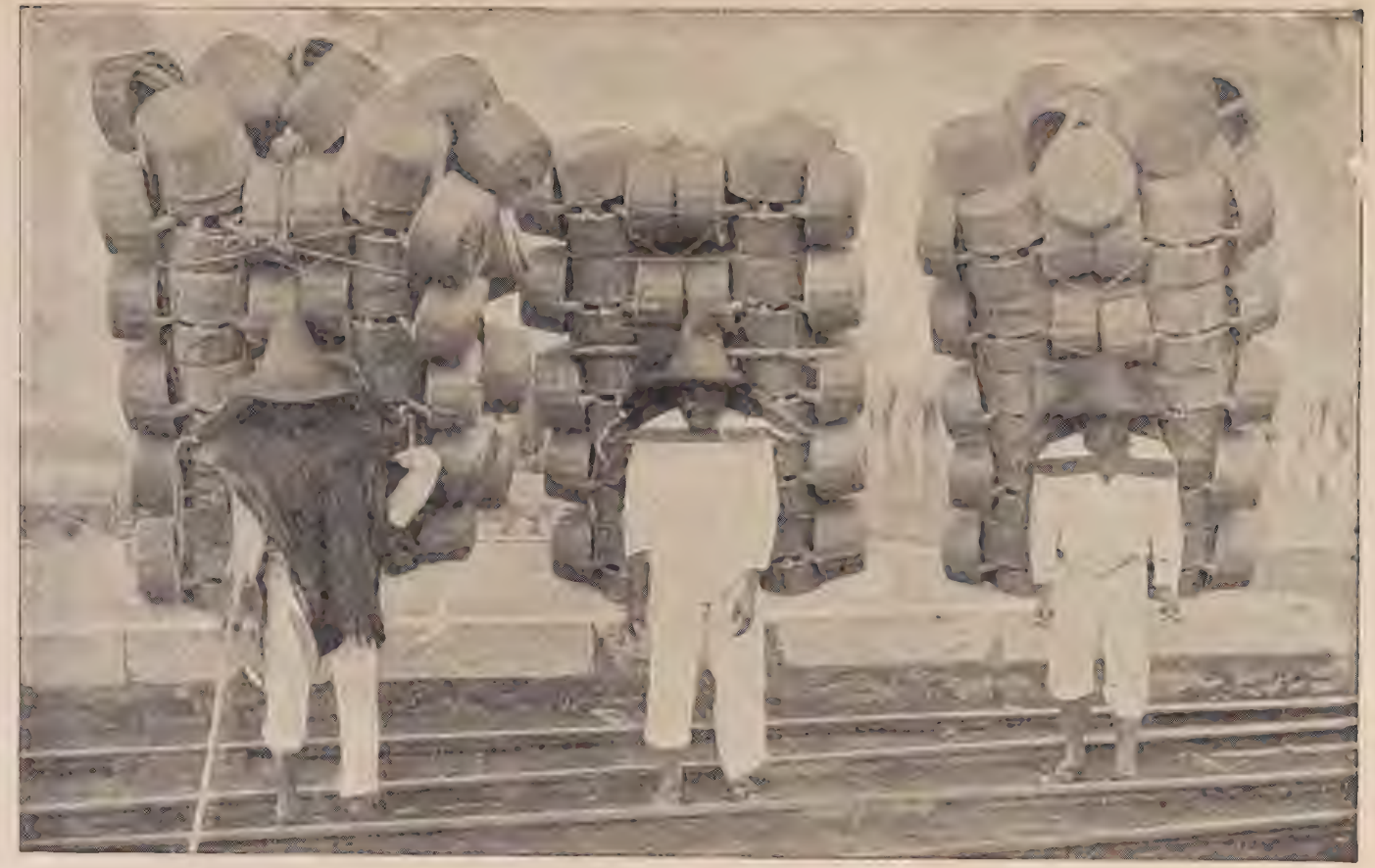
STONEHENGE—REMAINS OF AN ANCIENT DRUIDICAL TEMPLE, SALISBURY PLAIN, ENGLAND

An attempt is being made to solve the problem of the age of Stonehenge by means of modern astronomy. The theory which is being worked upon is that formerly the collection of stones pointed towards the rising sun, on June 21st, the day on which the sun reaches its most northerly position. Looking from the Altar Stone one sees the sun rising near the top of the Friar's Heel on June 21st. But each year, on the longest day, it rises a little less to the North than it did the previous year. The amount of the yearly shift in the sun's position is known, so that by calculating the difference between the sun's present position and the position it held on the old axis of Stonehenge should give some solid proof of the age of this wonderful "temple of the winds."

SCENE IN THE COURTYARD OF THE MONASTERY AT HIMIS ON THE OCCASION OF THE ANNUAL SPRING FETE OR CARNIVAL

THIS GROTESQUE FESTIVAL TAKES PLACE ALL OVER THE MYSTERIOUS LAND OF THIBET. IT IS ORDERED BY THE HEAD OF THE BUDDHIST HIERARCHY, WHO IS SUPPOSED TO BE THE LIVING INCARNATION OF BUDDHA

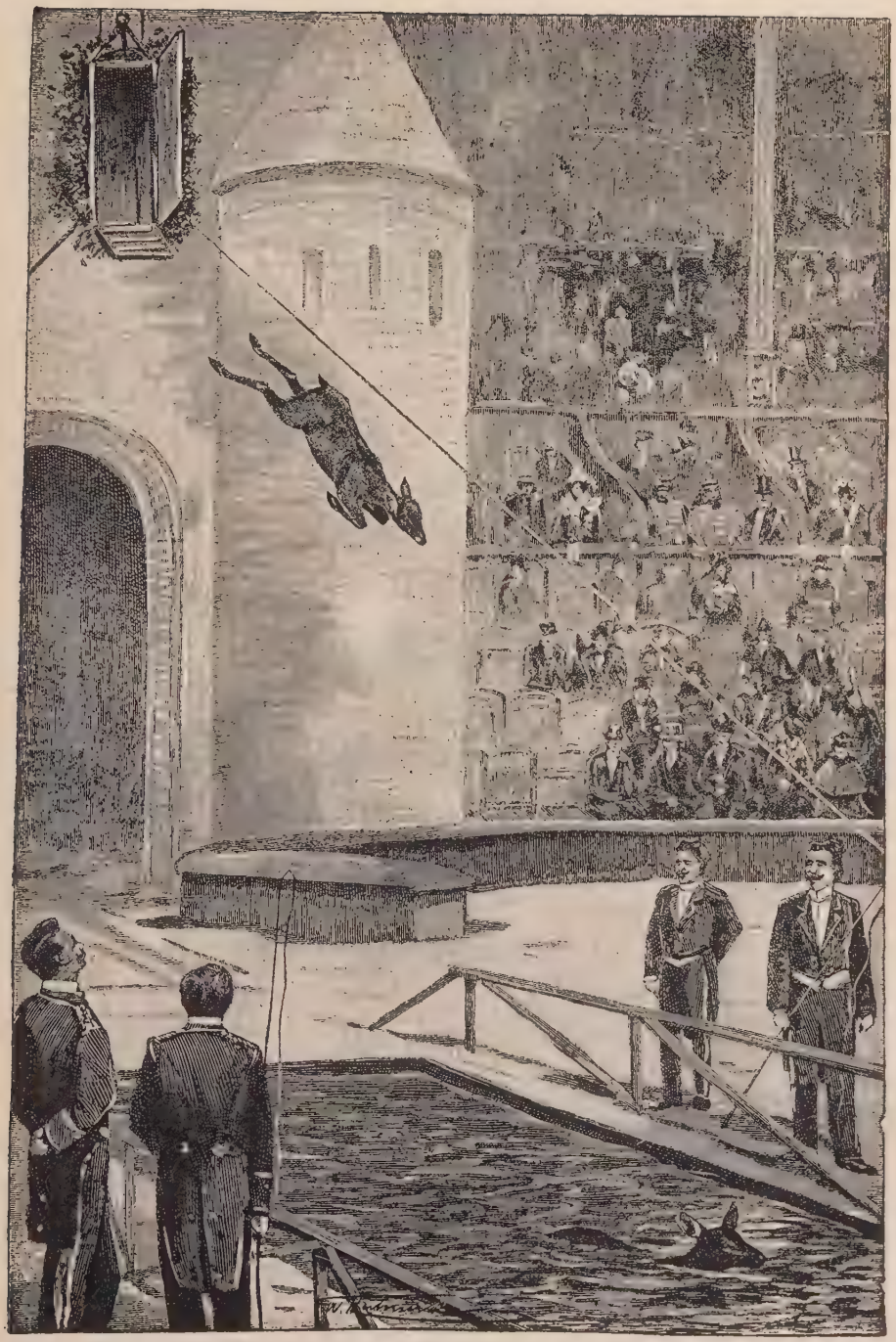
A DIVER'S BATTLE WITH SHARKS



WHOLESALE LOADS OF MEXICAN BASKETS

SURPRISING SKILL IS SHOWN BY THE NATIVE BASKET MAKERS, WHO FIND A READY MARKET FOR THEIR WARES

RAILWAY FOR WOOD SLEDS IN THE VOSGES MOUNTAINS, FRANCE

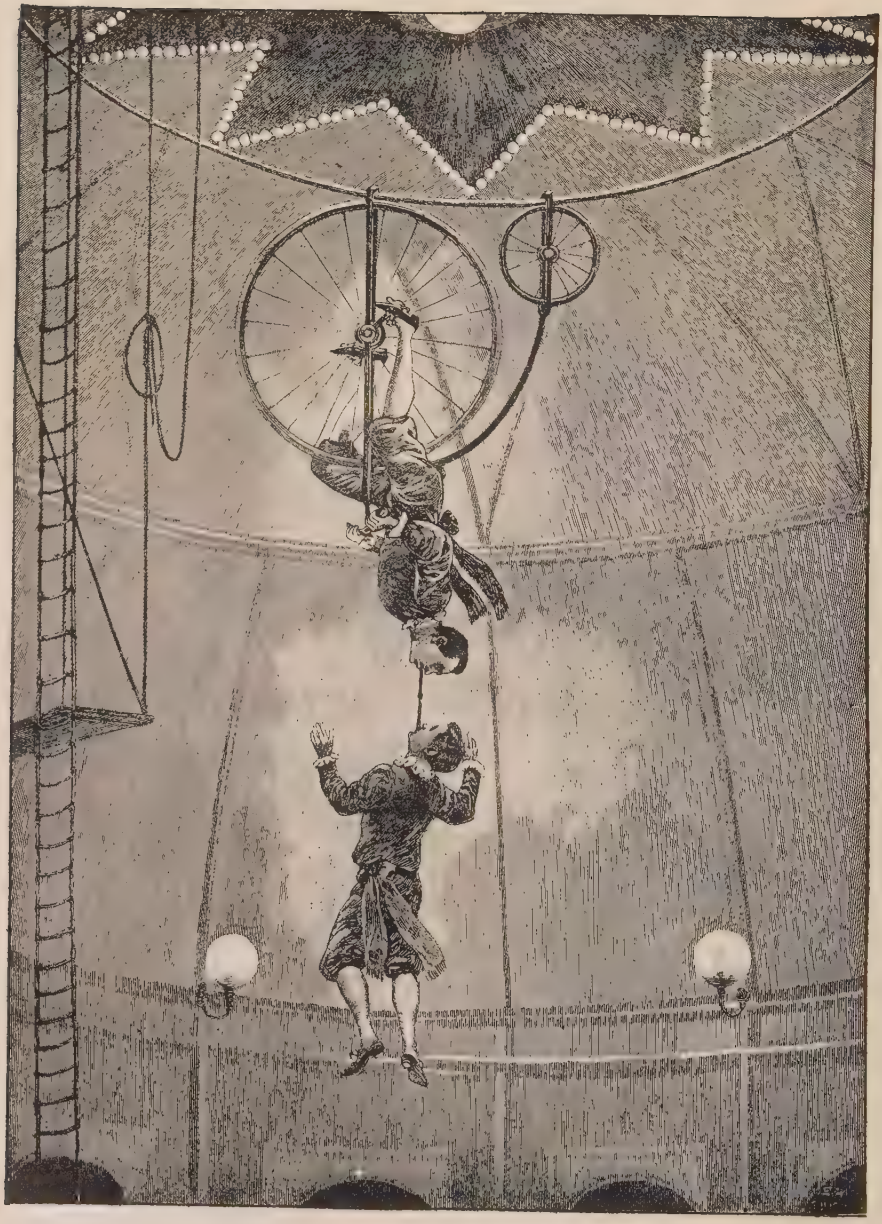


REMARKABLE LEAP OF DIVING ANTELOPES

A NOVEL EXHIBIT AT THE WORLD'S FAIR, ST. LOUIS

WONDERFUL FEATS OF BOXING HORSES

THE TWO STEEDS BOX WITH TWENTY OUNCE GLOVES, TAKING CORNERS JUST LIKE PRIZE FIGHTERS. THEY COME TO THE FRONT AND SHAKE HANDS, AND USE THEIR GLOVES WITH MORE SCIENCE THAN SOME HUMAN BOXERS



FEATS ON A BICYCLE SUSPENDED FROM THE CEILING

CHAPTER I.

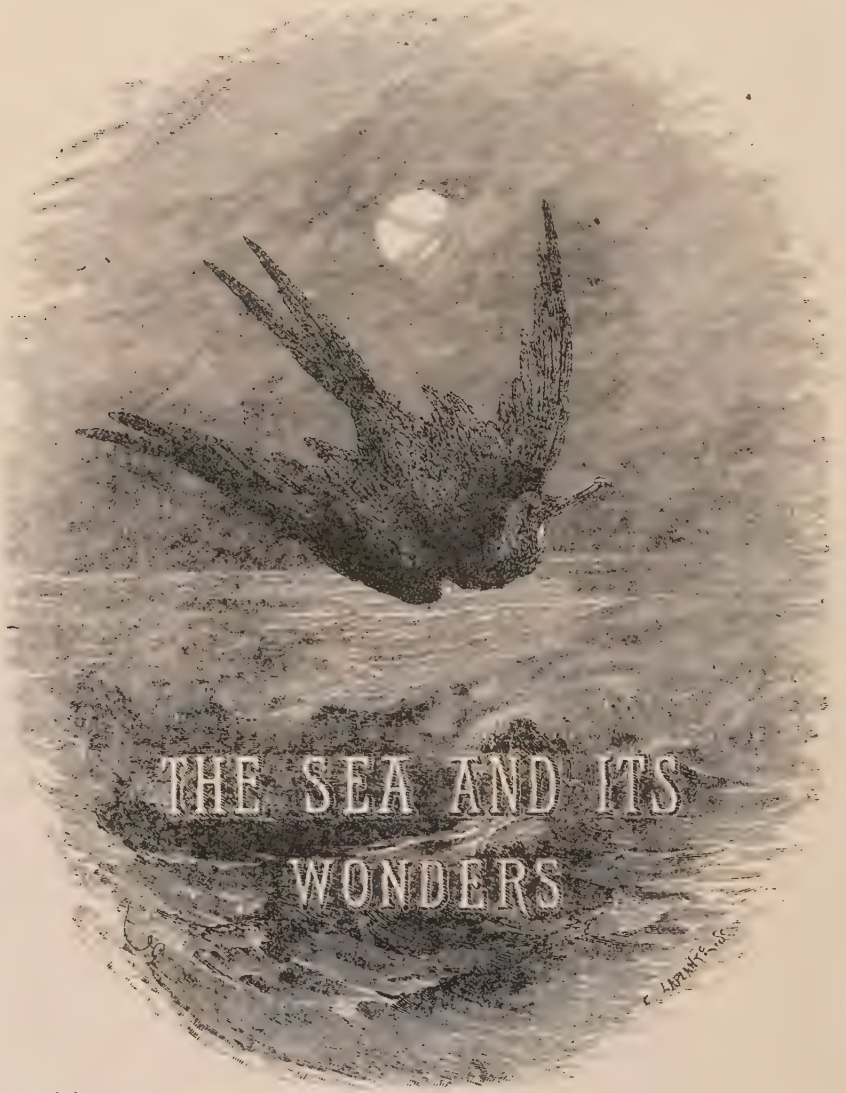
WONDERS OF THE OCEAN.

Ocean a World in Itself—Wonderful Sea-Plants—Mermen and Maids—The Famous Nautilus—The Devil Fish—Immense Poulpe—Crabs that Seem to Reason—Nest-Building Fishes—Curious Barnacles—Sponges—The Saw-Fish—The Torpedo—Rainbow Beauty of the Sea—Colored Waters—The Flying-Fish—Dolphins—The Sea-Serpent—Ocean Flowers—Sea Anemones—A Crab with a Pack on his Back—The Wonderful Star-Fish—The Medusæ—The Coffre-Fish—Creatures in Armor—A Thieving Crab—Marvelous Corals—A Strange Fan—The Brain Stone—Singular Fishes—The Sea-Porcupine—A Fish that Travels on Land—Gems of the Ocean—The Gulf Stream—Bay of Naples and Vesuvius—Wonderful Depth—Sea-Cucumber—Female Pirates—Strange Tales of the Ocean.

WONDERS abound in the ocean. It is a world in itself, and is subject to its own laws. "In this great and wide sea are creeping things innumerable, both small and great." Animals, plants and insects have a home within its waters, far beyond the domain or even the reach of man. The fantastic forms and shining creatures that people the recesses of the deep are here placed before the reader, and the sea is made to give up its marvelous creations.

The sea is full of plants that float about in the water, or else are attached to some rock at the bottom of the ocean. For a long time nobody cared about sea-weeds, or took the trouble to examine them, but now they are as carefully studied as the plants that grow on the land. Many of them are of delicate formation, and very beautiful. They make gardens at the bottom of the ocean. Their colors are red, and green, and yellow, and purple. All manner of living creatures dart about among them. The scene is as varied and as gay as if it were on land. Indeed, it is almost like fairy-land. When night comes, millions of tiny creatures shine and sparkle like the glow-worm or the fire-fly. The depth of the ocean is full of beauty by night and by day. Sea-weeds are quite different from land plants, though they have leaves and a root. The root holds the sea-weed to its place on the rock. But it does not suck up the moisture as the root of the land plant does. There are no little cells in the leaf of the sea-weed to carry the moisture all over it. It must be plunged entirely in water, if it is wanted to live, but it will retain its color when taken from its briny home, and preserve its beauty a long time.

Mermaidens and mermen have from early ages been reckoned among the wonders of the sea. Poets have sung of their wondrous beauty and power, historians of the most irreproachable veracity have



chronicled their appearance; writers of natural history have asserted most decidedly a belief in their existence, and even in the present day there are men of education and science who believe that if Nature has not produced a mermaid, she has been wanting in her duty, as no

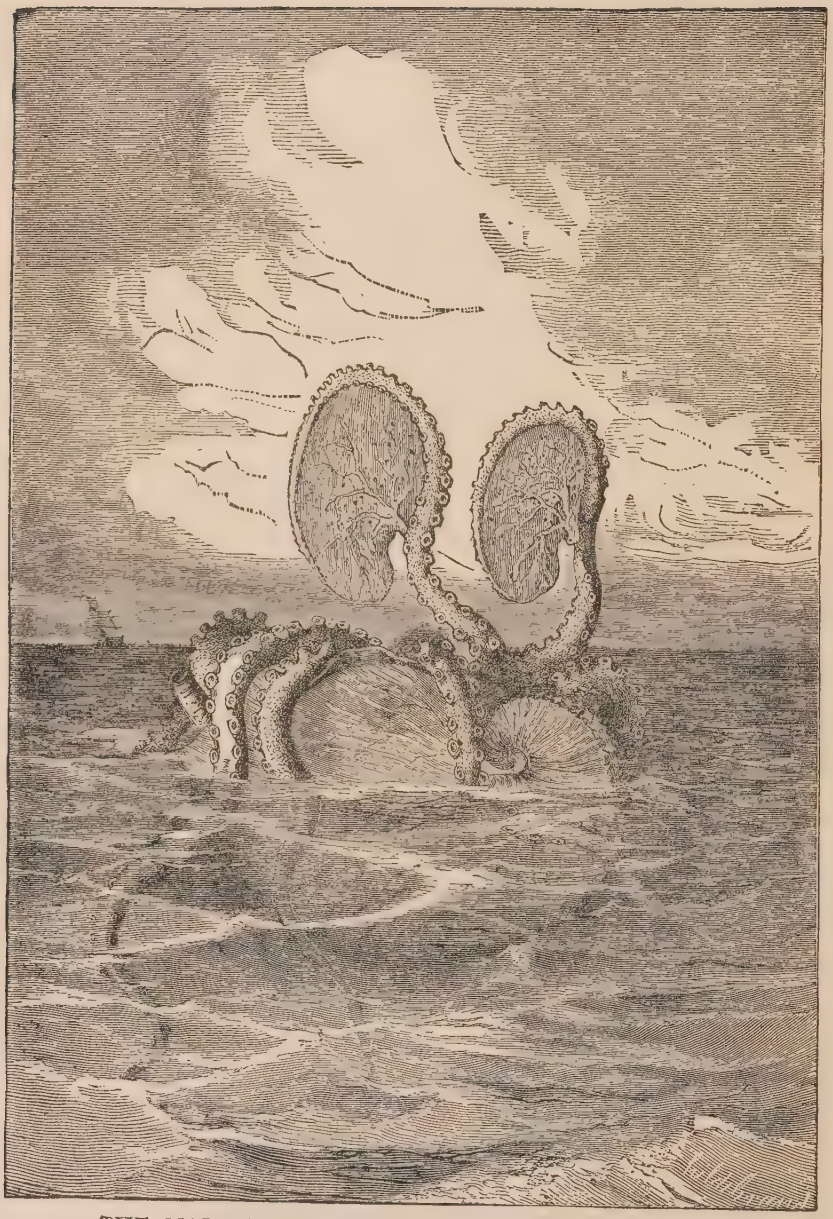
having completed the chain of vertebrate animals. It will not be thought surprising that the idea of the poet differed considerably from that of the man of science. There is an old story extant of the fishing-up of a merman on the Sussex coast in 1187. This creature, who acted like a man in every respect but that of speech, was kept by the governor for six months, when we are left to infer that it died, but the chronicle sayeth not.

A singular story is told by Captain Richard Whitbourne, of Exmouth, in Devonshire, of the appearance of a mermaid in the harbor of St. John's, in the year 1610. From the description he gives of it, he must have been favored with a sight of a very near approach to the poet's ideal; around the head he thought he saw many blue streaks resembling hair; fear, however, prevented his examining it more minutely, for on seeing it approach him swiftly, he fled with precipitation. Subsequently, it went to a boat wherein the captain's servant was with several others, put its hands upon the side of the boat, much to the terror of the men, one of whom struck it a blow on the head, which caused it to loose its hold; it afterwards swam to other boats, the men in which fled ashore and watched it from there. The latest mermaid known was that exhibited by Barnum, a few years ago, and was a singularly ugly object. It proved, on examination, to be an ingenious combination of the head of a monkey with the tail of a fish, and was a transparent humbug.

The sea, however, produces inhabitants sufficiently wonderful without our manufacturing from imagination any such curiosities as mermen and mermaids, which are simply freaks of fancy, and nothing more.

THE WONDERFUL ARGONAUT.

One of the families of cuttle-fish lives in the most beautiful dwelling that was ever formed by the hand of Nature, a dwelling that has been the wonder of mankind in all ages, the shell of the paper nautilus, or argonaut. Only one of this tribe is possessed of an outward shell; and, certainly, it makes up for the ugliness of its race, that is, as far as the shell is concerned. The creature itself is a mere cuttle-fish with long arms. It sits quite loosely in its shell, and is only joined to it by a pair of muscles. It had the name of argonaut given to it, for it was once thought to be a first-rate sailor. The Argonauts were a band of heroes, who went in search of the Golden Fleece. It was even fancied that the first idea of a ship was taken from the shell of the nautilus as it glided over the sea, using its arms for sails. A great deal of poetry, and of prose too, was written on the subject, but it has all turned out to be a mere romance. The argonaut is not often seen to sail. It creeps at the bottom of the sea, using its arms as feet. If it swims, it is by forcing the water through its air-tube, as the cuttle-fish



THE MARVELOUS ARGONAUT IN THE OPEN SEA.

does. It is, now and then, found on the surface of the waves; but the moment it is alarmed, it hides itself in the shell, drawing in the whole of its body. Then the shell loses its balance, turns over, and sinks to the bottom. It is therefore no easy matter to catch sight of the paper nautilus, much more to get possession of it.

The two arms of the creature, which were thought to be used as sails, end each in a broad membrane. The broad membranes do indeed look a little like sails, but they are never used for any such purpose. The creature often keeps them folded over its shell, as if to protect it. Then the shell is quite hidden from sight. But what is the use of these two sail-shaped arms? This has been found out by careful study. They are the organs by which the beautiful shell is made, and by which it is kept in good repair.

SHELLS OF THE WONDERFUL NAUTILUS.

The vela or arms of the argonaut have the faculty of depositing earthy matter wherever it is wanted. This was found out by a lady who devoted herself to the study of the argonaut. She was determined to begin at the beginning, and she reared some little argonauts from the time they came out of the egg. As they grew up, she watched them very narrowly. She saw the process of depositing the shell, and its gradual growth. When the shell was fully formed, she made an experiment. She broke a shell, and then left it, to see what would happen. The next day she went to look. She found a thin cobweb-like sub

stance spread over the edges of the broken pieces and joining them together. The next day she looked again. The substance had thickened, and the edges were much firmer. Day after day the repair went on. The substance grew harder and thicker, until at length the edges were firmly joined and the shell mended. The lady had watched the whole proceeding, and she declared that the argonaut applied its vela to the outside of the shell. And she felt certain that the glutinous substance which mended the shell came from the vela.

There is a relation of the argonaut that makes a shell with chambers in it. This is a shell which no doubt you have seen many times, for it may be met with in every collection of shells. It is called the pearly nautilus. The creature that lives in the shell is so timid and keeps in such deep water, that it is very rarely caught sight of. Only once has the shell been taken with the animal in it.

The shell of the pearly nautilus is as curious as it is beautiful. It has a number of chambers in it, one after the other. The last formed is the largest; and here the creature lives, the empty rooms being behind it. At first there was but one room; the creature lived in it. But its wonderful membrane went on secreting shelly matter, until it had formed another. When all the chambers were finished, and as it were shut up, the nautilus had attained to its full size. Then it lived in the last cell of all, having crept to it through the rest. A fleshy tube unites all these chambers together, from one end of the shell to the other. This tube ends in the body of the animal, and increases with its growth. Ages and ages ago, when the lily stars were in their beauty, a kind of nautilus that is now extinct lived in the sea. The remains of the shells are found in a fossil state, and are called ammonites. They show what fine forms of life once existed.

THE CUTTLE-FISH.

The mollusks, or soft-bodied animals, compose a very large class. Creatures of different shapes and sizes belong to it. The fiercest, ugliest, and most dreaded of the whole tribe is the cuttle-fish. The name of the order to which he belongs is called Cephalopoda. The word is taken from two Greek words meaning "head," and "feet." And, as you perceive, his feet grow out of his head. You can call them arms, if you like. He can not only creep on them at the bottom of the sea, but he can seize his prey with them. In some parts of the world, the cuttle-fish grow to a monstrous size, and are frightful objects.

Notice the deadly apparatus in the arms of the cuttle-fish. There are rows of suckers down each arm, as every specimen will show. These do not suck the blood of the victim, as is sometimes stated. They are so many wonderful machines to enable the arms to cling closer to the

prey: so close indeed do they cling, that no power can force them away. Each sucker is a kind of cup, composed of a muscular membrane, and with a thick fleshy rim. The creature has the power of exhausting the air within the cup. When the arms have seized upon an object, the rims of all the numerous cups at once adhere or stick to its surface. The cuttle-fish will rather have his arms chopped off than quit his hold, and no object within his grasp can possibly escape.

In some kinds of cuttle-fish there are two arms longer than the rest

THE SINGULAR CUTTLE-FISH.

From the middle of each sucker there is a sharp strong hook, which can be plunged into the slippery surface of the prey and help to secure it. The prey, thus seized, is hurried to the mouth. If it has a shell, the shell is soon crushed by a hard, horny beak, like that of a parrot, and with which it comes in contact. The jaws are literally imbedded in muscle, and open and shut with the utmost force. Thus a victim, once dragged to this terrible mouth, is very soon devoured. A number of sharp horny hooks are placed on one part of the tongue. These

hooks bend backwards, and so when the cuttle-fish swallows, they help to drag the pieces of food down its throat. The creature has two eyes, of a remarkably unpleasant expression. In one species the eyes are placed on little stems or stalks made of muscles. They can thus move about, and see all ways at once.

The cuttle-fish cannot be admitted into the rank of the vertebrated animals—that is, animals with a bony skeleton. Like the polyps and the star-fishes, it secretes a hard substance within its body. But these secreted pieces are quite different from the bones of animals. They have no connection with the body, and do not possess, in themselves, the means of growing, as our bones do. They are mere dead shells or pieces of stony substance, formed layer by layer, and laid on from

THE IMMENSE POULPE FISH.

without. The cuttle-fish is formed to live in the sea, and it breathes as the fish does, through gills, or, as they are called, branchiæ. These gills are hidden in a hollow of the body. This hollow or tube expands and contracts, as our lungs do. It is open to the water by two slits: one lets the water in, and the other allows it to flow out. Sometimes the cuttle-fish will suddenly and violently expel the water in its tube. This sudden movement will cause the creature to shoot through the water like an arrow. Sometimes it will even spring up into the air, as the flying-fish does, and reach out its long arms for the prey.

The sea is full of cuttle-fishes, as it is of star-fishes. They are found everywhere. There is one hideous creature called the poulpe or polypus It leads a solitary life on some rocky coast. It lies in a hole or cleft of

the rock, its arms stretched out ready to seize a victim. But, as a rule, the cuttle-fish likes society. Except the poulpe, all the other tribes wander in flocks or troops. They are so greedy that they make havoc among the smaller inhabitants of the sea. When they are near the shore they eat up all the fish they can find, so that there are none left for the fishermen to catch. And they are cruel as well as greedy; like the tiger on land, they will kill for the mere sake of killing.

As the cuttle-fish has so many enemies, Nature has given it a means of defence besides its suckers and long arms. There is a bag in the body full of a black fluid like ink. If the creature is alarmed, it throws out a quantity of this ink, and makes the water so black that no one can see where it is. Under cover of the black cloud it escapes. This ink is called sepia. It is very useful to artists in painting their pictures; and when dried, it can be kept any length of time without spoiling. The ink-bag taken from a fossil cuttle-fish had ink in it just as good as if it had been fresh. Cuttle-fishes multiply themselves in a wonderful manner, so there is no fear of the race being destroyed. The eggs are in a great bunch, something like grapes, and are fastened to the stem of a sea-weed. But if the cuttle-fish lives a long way from the shore, its bunches of eggs are not fastened to anything. They float on the surface of the sea. The warmth of the sun hatches them. Then out come the little cuttle-fishes, and begin at once to wander about in troops, and to lead a life of plunder, nor do they need much teaching.

WONDERFUL INSTINCT OF THE CRAB.

In the mountains of some of the West India Islands live what are called "violet crabs," which hide themselves for a great part of the year either in holes of the rocks or in the hollows of trees. Scarcely anything is either seen or heard of them. All at once the rainy season sets in with great violence, and then a commotion takes place among the crabs. They are seized with a wish to go to the sea-side. The mother crabs want to lay their eggs on the sea-shore.

So the vast host of crabs set out on a journey thither, and the compact line sometimes extends for three miles. They literally cover the roads, woods and gardens on the route, and their noise may be heard a long distance. They travel by night, because this is the safest time, and the strongest go first, as it were to clear the way. Then come the mother crabs, and last of all, those that are old and feeble. No obstructions on the road, such as fences or ditches, can stop them, and if anyone meets them they rattle their claws and try to frighten him away with a great noise. If a door of a house be open, they are very likely to march in. Instinct has taught them the nearest way to the sea, and they never turn from it. Should a poor crab get hurt, the others eat him.

After the army reaches the sea a great deal of business has to be done. First of all, the crabs take a bath in the waves. Then the mother crabs lay their eggs. When this is over, all the crabs retire into holes and snug corners, to cast off their armor. After the wriggling and struggling has been gone through, the crabs come out weak and faint, and have to wait a little time before they can do anything more. As soon as they have recovered strength enough, and their new armor has begun to appear, they set off home again. But the journey back is not quite so pleasant. The crabs are tired and feeble, and a great many of them are caught and killed by the way. Indeed, but a small remnant of the host gets safe back. After a time the little crabs come out of the shell, but they are not in the least like their parents. The young crab is the most absurd looking creature in the world. Its head is like a helmet with a long spike sticking out of it. Then it has a long beak, and a pair of great eyes. At this period of its history it swims merrily about in the water. It takes some little time before the young crab grows to be at all like its parents. But, by degrees, it undergoes a series of changes, and leaves off swimming. It is now, in fact, a true crab, and is ready to set off to the mountains. Then the roads, far and near, are sprinkled over with little crabs scrambling along as fast as they can, and led by that wonderful guide—Instinct. Dangers beset them on every side, and birds and animals alike feast upon them. But the little army still pushes bravely on, and at length a remnant of it reaches the mountains in safety.

Fishes do not care about their young ones. They lay their eggs in the water, and leave them to hatch, without taking any trouble. This is their usual habit; but there are a few exceptions to the common rule. There is a fish called the hassar. It lives in America, in pools and streams. And when its pool dries up, it sets out to find another. It has the sac of water under its gills, so it can travel on dry land, and bear the heat of the sun. It builds a nest for its young. In the fine spring weather, it begins to make its little house which is like a hollow ball, flat at the top. It is made of the fibres of the rushes and the water-plants. It has a hole, through which the fish can get in. People who wish to catch the fish hold a basket to the hole, and begin to beat the nest with a stick. The fish gets very angry at being disturbed. It spreads out its hard fins, with their sharp points, and gives a spring forward. Then it falls at once into the basket, and is caught.

There is an active little fish that lives on our own shores, and has fins on his back. He is called the stickleback, and also the thornback. He takes all the trouble from his partner, for he makes the nest himself. He twists bits of sea-weed and corallines together, and glues

THE WONDERFUL NEST-BUILDING FISH.

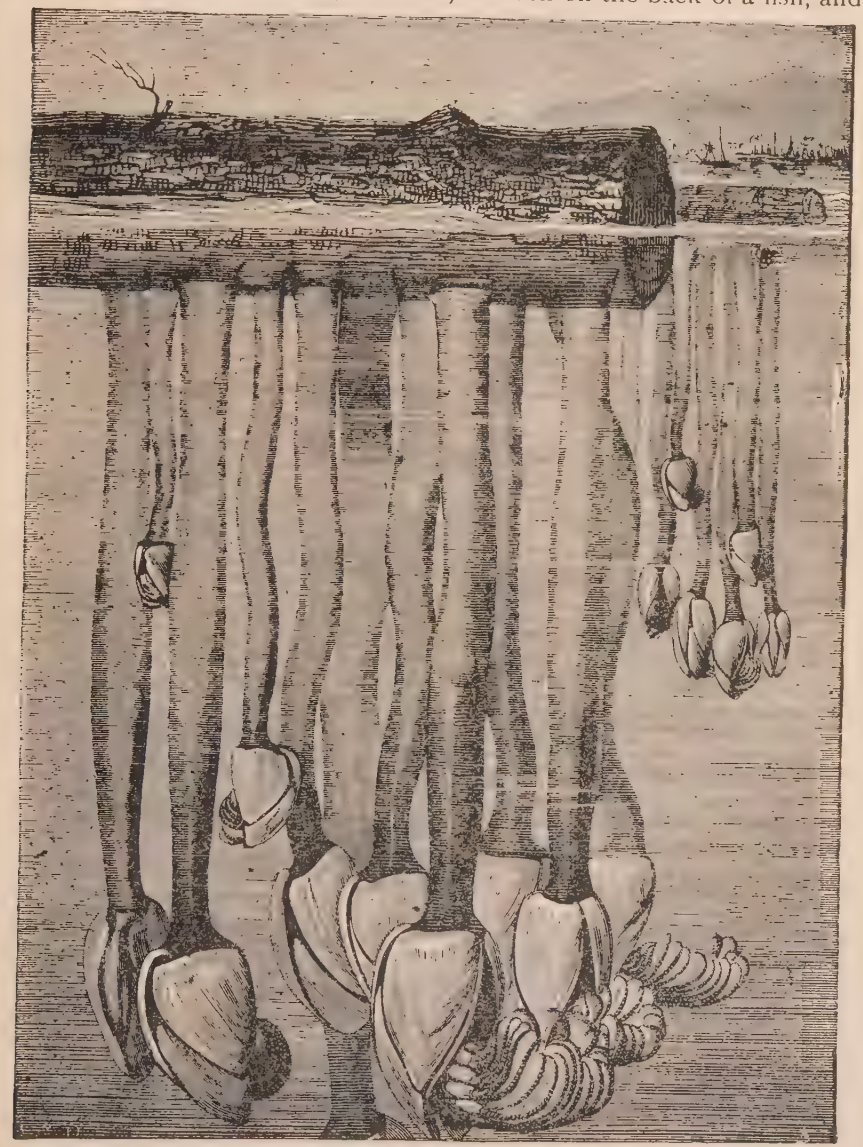
them with a gummy matter, that Nature has given him, and that comes out like a thread. The nest is in the shape of a pear, and has a way out and a way in. It might be said to have a front door and a back. The fish takes a great deal of pains with his nest, and will alter it over and over again before he gets it to his mind.

When the eggs have been laid by the mother fish, he keeps guard over them. And when an enemy comes near, and wants to devour them, he darts out and pushes him over. Naturalists are very fond of watching the stickleback taking care of his young. They say it reminds them of a hen and her brood. If a young fish ventures too far from home, the stickleback swims after it, seizes it in his mouth, and carries it back again.

It requires a good deal of faith to believe that barnacles are related to crabs, for they are not the least alike, and the first is fixed like a shell-fish on to pieces of timber floating about in the sea, or to the rocks washed by the tide; whilst the last has legs, claws, eyes, and the power of moving and swimming. Yet it is quite true that the barnacle belongs to the same class of animals that includes the crabs, shrimps, and lobsters. If a piece of rock is put into a large glass full of sea-water, many things may be seen on it which are of a white color, and whose shape is something like that of a thimble with the top battered in. If they are examined, it becomes evident that the conical outside is formed of several little bits of hard shell joined together very carefully, and that the top has a valve in it. When the water is quite clear and quiet, a small flapper is poked out through the valve, and is moved to and fro with a motion like that of opening and shutting the fingers. The flapper has some long bristles attached to it, and they are beautiful, feathery-looking things when examined under a microscope. The movement goes on for hours, and ceases upon the least alarm. Then the flappers are withdrawn, the valve closes, and the barnacle—for such is the creature—looks again like a conical piece of stone. The flappers are the lungs as well as the hands of the barnacle, and minute living creatures are entangled by them and passed by a current of water into the mouth, which is within the shell. When the barnacle produces its eggs, it ejects them with a stream of water, and they float about in the sea, being very minute things. They soon become hatched, and then it is that the reason becomes clear why barnacles and crabs are placed by zoologists in the same class.

The young barnacle is just like a shrimp, with a long body, many long legs close to its head, and a large tail; it has eyes, and swims about most vigorously. It appears to be constantly in movement, and although actively employed in swimming and in crawling, it does not

care to seek for food. After awhile, the young free-swimming creature rests upon a piece of rock, or wood, or even on the back of a fish, and



THE CURIOUS BARNACLES.

then a wonderful alteration takes place. The long legs and feelers near the head grasp the substance on which the creature is to live for the future, and a gummy substance comes from a gland which has been

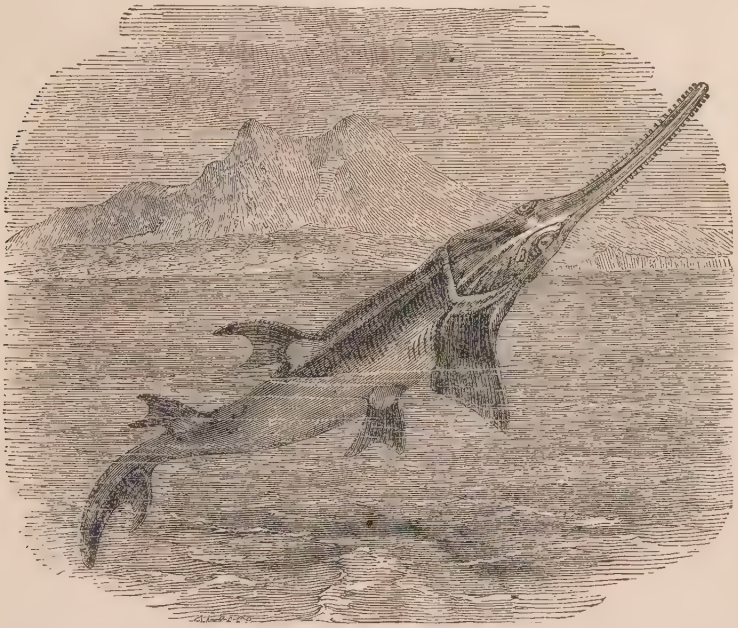
growing for some time close to the head. The gum sticks the legs and the feelers to the substance, the eyes diminish in size and are no longer seen, the tail and the hind legs grow into the feathery flappers already noticed, and the shell of many pieces encloses all. The barnacle is then fixed for life, head downwards, and it loses its organs of sight and receives a mouth and stomach, which it had not before, when in the free-swimming state. All barnacles do not undergo this change, for the males of some kinds live inside the conical house which holds the female, and never have houses of their own, for they remain in the free-swimming form. All the animals of the crab class have to undergo a change of form before arriving at maturity, and the common shore crab, when it is first hatched, is a long thing with a great head, and legs fitted for swimming, and not for crawlling. As it grows, the body shortens by curling the tail end underneath, and the legs and claws grow out of the swimming apparatus. Some of the barnacles that live on coral reefs are very beautiful, and their shells are ornamented in imitation of the flower-like polypes of the stony madrepores, which they resemble.

THE SPONGE AN ANIMAL.

Among the wonders of the sea there is none more remarkable than the common sponge. For a long while it was disputed whether the creature belonged to the animal or vegetable world, and until quite lately the opinion prevailed that it was a subject of the vegetable kingdom. Modern science has ascertained that sponge is beyond all question an animal production—not the work of any highly organized animal, but still of creatures distinctly animal. Sponge, as we commonly see it, is an intricate network of filaments of a horny substance, and solid, having here and there in their midst caverns or cells, into which the passages that honey comb the sponge converge. Imbedded in these filaments are numerous tiny, needle-shaped pieces of calcareous matter, with a knob at one end and a point at the other.

Here is an abode in which dwell, not crabs or fish, or anything of their respective kinds, but an infinity of small gelatinous cells, each one possessing a perfectly independent existence, and able, when detached from its fellows, to move onwards by the extension of its substance. There are many different sorts of sponge; some of them inhabit our own coasts, some live in fresh water, but the finest specimens of the best kinds of sponge are to be found in Tropical waters, in the Mediterranean, in the Grecian Archipelago, in the East and West Indies. The most valued sorts are found at some depth below the water, and must be dived for, as they never allow themselves voluntarily to appear above the surface. They anchor themselves to any good holding-ground that comes in their way—a branch of coral, a

jutting piece of rock, anything that happens to be convenient. Mention is made of a large sponge being found attached to the back of a living crab. Sponges resemble coral in this, that when exposed to the action of a rough sea they become larger and thicker, and grow more rapidly than when in situations where the conditions are gentler—a fact which is perhaps due to the frequently-changing medium which brings at every turn and roll a fresh supply of food for the gelatinous aggregation of cells which is the true sponge, and a fresh supply of material to strengthen the horny fibres and spicula which are the skeleton and framework of the sponge animal, requiring nourishment.



A FISH WITH AN EXTRAORDINARY WEAPON.

Some sponges have a regular shape, as a cup, globe, or tree; while others grow, as it were, anyhow, covering the rock, shell, or whatever else it may be to which they are attached with a formless cover of soft spongy material. If two sponges of different kinds meet in their wide home in the depths of the sea, it is not found that they ever unite, nor do they ever cross the breed. A mechanical union there may be, nay, there often is; but so far from any disposition to unite having been seen, experience declares that disunion is the invariable rule. No matter how much the sponges may be interlaced and intertwined, they remain ever distinct and distinguishable, preserving their own individuality as closely as any of the higher forms of life.

Certain sponges have the faculty of boring into substances of which the hardness would seem to defy any but the best mechanical contrivances. Shells, coral, rock, are pierced with surprising facility. The sponges bore their way into the rocky substance, maintaining their communication with the water, and by continuous attacks disintegrate the mass, so furnishing rubble and small stones for the building which other handicraftsmen of the ocean are perpetually rearing.

There is a fish related to the sharks, that has a terrible weapon. It is called the saw-fish. It is furnished with a long saw, jagged at both

THE REMARKABLE ELECTRIC FISH.

edges. Its body is covered on the upper surface with sharp spiny knobs, a little like the rays. It is as savage as its relation the shark, only, happily, it is not so often met with. It attacks the whale, as the sword-fish does, and will bury its weapon in the huge animal up to the very roots. It will also plunge its saw into the side of a ship. You would wonder how the edges of the saw could be forced through either the whale or the ship. But the fish comes to the attack with such violence that nothing can resist the shock, or withstand its fury.

There is a fish that has a mysterious and powerful weapon of defence

It lives in the Mediterranean Sea, and is called the torpedo. The electrical eel can give shocks as powerful as an electrifying machine. The torpedo has the same power of giving a shock, but it is much more feeble. The torpedo has a clumsy body, in shape a little like a musical instrument. The machine Nature has given it, and that produces the shock, is very curious. It consists of a number of tubes, and is not unlike a piece of a honeycomb. The tubes take up the whole length of the body, between the upper and under surface, and a secretion of thick mucús is found in them.

The torpedo is very much dreaded by its neighbors in the sea. It feeds upon fishes, and whatever it can find, and uses its machine to stun its prey. In the warm seas of the Tropics very large torpedoes are found. If you were to touch one it would give you a curious sensation. You would feel as you do when you give your elbow a blow against some sharp corner. The torpedo is a sluggish creature, and likes to bury itself in the sand. This is just the time when it is most to be dreaded. If an unlucky person were to disturb it by accident, it would give him one of its most angry shocks. In these days a great deal is said about electricity, and the doctors are trying to make use of it to cure many complaints. But so long ago as the days of Antony and Cleopatra, the torpedo was used as medicine too. Its shocks were thought to cure pains in the head, and various other maladies. And in later times, if a man had the gout, he was told to put his foot on the torpedo, and to keep it there, until he felt a sensation of being numbed, as high up as his knee. Electricity is a very ancient remedy.

RAINBOW COLORS OF THE SEA.

There is a very beautiful sight often visible at sea. Ships appear to sail through an ocean of color. There are streaks of red, and blue, and crimson. When the vessel moves, there seems to be fire issuing from her sides, and rolling along the water. Sometimes a troop of dolphins are seen playing about among the waves. The effect of the shower of light which falls from their shining scales, is very beautiful indeed. Each drop of water sparkles like a gem. What occasions all this glorious show of light? The presence of a substance which is widely spread through the regions of nature, called phosphorus. Phosphorus is a deadly poison, and when it is seen by itself, separated from the bodies in which it lives, it looks like a little white stick of a waxy nature. People who sell it keep it in water to prevent accident. When it is taken out of the water it begins to smoke, and after a time to burn. The slightest friction makes it burst out into a flame. Now, this burning, inflammable substance shines, in the dark, like fire, and it is this which makes the sea shine. But how came it in the sea? Because it

exists in the bodies of millions of creatures that live in the water. Some of these creatures are so tiny, that you could not see them except through a microscope. But when myriads of them are together, they have a splendid effect. They make streaks and bands of light. Indeed, they seem as if they had set the waves on fire.

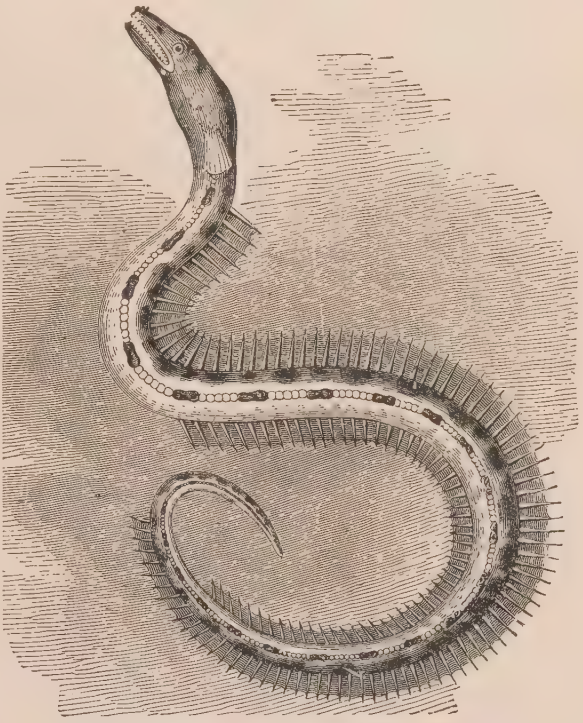
The waters of the sea, in different places and at different times, present almost every hue of the rainbow. Apart from the influence of the condition of the atmosphere on the light reflected by the ocean, there are seas which always present one shade of unusual color. Thus there are the Yellow Sea of China, the Vermilion Sea of California, the Red Sea, the Black Sea, and others. The hue of the last named is attributed to the frequent storms which agitate its surface, and the quantity of

FISHES THAT FLY—DOLPHINS IN PURSUIT.

earthy matter brought into its bosom by the Danube and other rivers. But the tinge of the Red and other colored seas is due to the presence of myriads of animalcules, while to the same cause is ascribed the "white water" of the Pacific Ocean. Seamen generally admit one conclusion with regard to color—that a green hue is a general indication of soundings, and indigo-blue a token of profound depth.

One of the surprising wonders of the ocean is a fish that can fly and give great jumps out of the water. The air-bladder of the flying-fish is very large. When it is filled with air, it takes up nearly the whole of the body. Its fins are very large, and almost like wings. They do not hinder it from swimming; when it is in the water, they are folded close to its body, and quite out of the way. When the fish takes its

jumps, it not only expands its fins but its tail. It skims along a little like a swallow. Indeed, the ancient writers called it hirundo, which means a swallow. It can fly about fifty or sixty yards at a time, then it drops into the water, and moistens its gills. After that it can take another spring. The fish gives these jumps to get out of the way of its enemies. In the Tropics, a shoal of flying-fish is often seen springing out of the water. Their silvery fins, and blue bodies, glitter in the sun, and look very beautiful. But this plan of flying is not always a safe one. There are a number of sea-birds ready to pounce on the fish when it gets out of water. The gull and the great albatross are always on the watch. For, in Tropical seas, the birds abound in great numbers. Flying fishes are often pursued by dolphins. In vain they give their flying leaps out of the water. On board ship, people amuse themselves by watching the flying-fish. If a light is brought, a shoal of them will drop on deck, attracted by it. The sailors think them a great delicacy, and say they are as good to eat as the best mackerel.

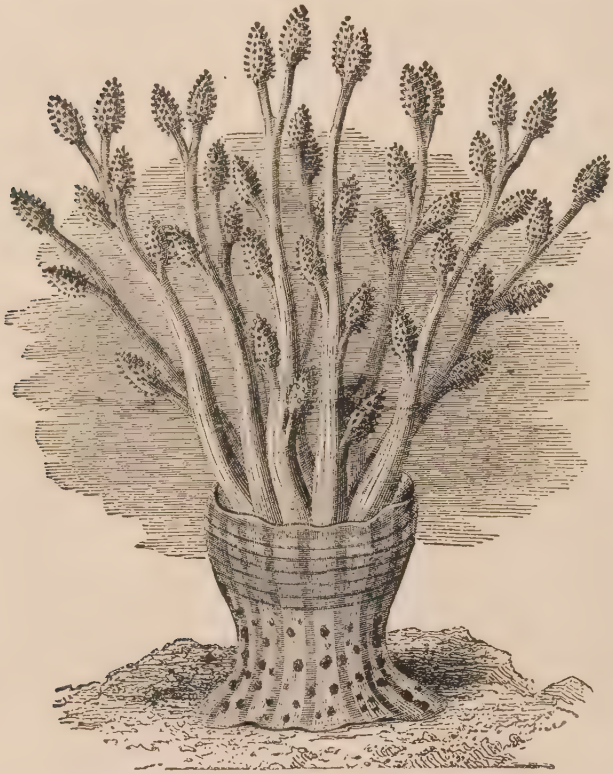


THE WORLD-RENOWNED SEA-SERPENT.

There is an inhabitant of the ocean which is of such a size and so closely resembles a serpent, that it is not surprising it should be a perpetual sensation and source of wonder and fiction. Its body is as thick as a man's arm, about six feet long, and it has a kind of snout. Its colors are brown on the upper part, and a silver-white beneath. It lives in the Mediterranean Sea, but has relatives in other waters. It does not approach, in any degree, to the fabled monster which goes by the name of the Great Sea-Serpent. Yet, in form, it is as much like a snake as can be. There is an eel in the Mediterranean Sea which the old Romans had a

great fancy for. They used to keep it in fish-ponds near the sea-beach, and prize it as we do gold and silver fish; only that we do not eat the gold and silver fish. But the Romans used to eat the murey. They thought its flesh a great delicacy. Julius Cæsar, at one of his banquets, had six thousand mureys given away to his friends.

We who live on land, far away from the deep recesses of the ocean, can form little idea of its hidden beauty. Branching corals, and fantastic shrubs, and brilliant sponges, are on every side. Sea-weeds cling to the corals, and wreathe them with gold and purple. The rocks are gay with flowers of ocean, that vie in loveliness with the lily and the rose. Bell-shaped jelly-fishes float amid the fairy scene, dressed in violet and crimson. Ribbon-like creatures glide about, and cross and re-cross each other, while brilliant-colored ones flash among the plants and corals, as humming-birds do in the groves of the Tropics. When night comes, the ocean-garden is still more beautiful. Millions of tiny creatures sparkle like stars. The larger animals look, many of them, like bodies of fire. In the day-time, they had no especial beauty. But now, they shine with gold or emerald. The ancients, who were very fanciful, might well people these fairy-like spots with sea-nymphs, and mermaids, and imaginary beings! They are not real flowers, but animals. They have been called plant-animals, because they are so like plants growing in the gardens of the sea. Their proper name is zoophytes, and they belong to the large family of polyps. The polyps that were makers of



TREE-LIKE ACTINIA.

islands, lived each in his cell, and did not roam about. These ocean-flowers can, and do move, though slowly. They grow each on its stalk, and are called sea-anemones, a very remarkable production.

Though it is in one of the lowest ranks of the animal world, you will find a great deal about the sea-anemone that is very interesting. Its body has six parts, or, if you like to call them so, members. First, there is the stem, or column. It rises like the stem of a plant, or the trunk of a tree. At the top, it is cut off, as it were, and there is a thick margin, or, as it is sometimes called, parapet or wall. Sometimes this wall is plain, and sometimes notched, or the outer row of feelers may grow to it. Sometimes the column is smooth, or marked with lines or furrows, or else wrinkled like the bark of a tree. Or it may be fleshy,

SEA—FLOWERS—HERMIT CRAB CARRYING ONE ON HIS BACK.

or else like leather, or soft as pulp. There is no end to its varieties. It may be covered with little knots or warts. These warts are, in fact, suckers, by which it can stick fast to any substance it chooses. The lowest end of the column is the base. It is a broad plate, forming a flat surface, by which the creature fixes itself. The upper end of the column is called the disk. It is round, and sometimes its edge has a frill, or number of frills, round it. The feelers grow out of the disk. These are hollow, and are arranged in circles, round the edge of the disk. Each feeler has a foot, and a tip. A great deal of work is done by these feelers. The anemone has neither eyes nor ears; but it has a mouth and a lip. The mouth is placed in the middle of the disk. The thick

lip goes round it. From the mouth, there descends a hole or cavity like a sac, only gathered into folds. It is open at the end and forms the stomach. Indeed, the stomach takes up the whole space within the column, and is divided into rude kinds of chambers or spaces.

Thus the structure of the sea-anemone is very simple. It has a column, a base, a disk, a mouth, a lip, a stomach, and a number of feelers, yet there is scarcely the appearance of organization. It likes to live among the rocks in some hole or crevasse. Here, it will unfold its crown of feelers, as a flower does its petals, and wave to and fro in the water. Its crown will not always be of the same color as the stem. It will be pale orange, or red, or white, or pink, or yellow. In fact, the anemone will be variegated, and wear all these colors at once. How beautiful it looks when fully expanded! How brilliant are its colors! But touch it ever so lightly, and all its beauty is gone. It draws in its feelers, and shrinks down to a button, or little knob of jelly. It is now ugly and disagreeable to look at. But let it alone, and its courage will begin to revive. It gradually rises, and its body gets filled with water. The column-like stem swells out, and the frilled disk unfolds like a crown of leaves. It will soon become as beautiful as ever. It is not merely going to display its beauty, in this pleasant nook it has chosen. It is a hungry creature, and is watching for its prey. A foolish worm comes swimming by. The anemone has no eyes to see it; but its feelers have been moving about, in the hope of meeting with something which is likely to serve for a dinner. They quickly close round the worm, and the anemone feasts like a king, then seeks another meal

THE WONDERFUL STAR-FISH.

The brittle star-fish, one of the most marvelous creatures that floats in the sea, has long arms which are like the tails of serpents. These arms are so easy to bend about in all directions that the creature can use them as legs to crawl, or as fins to support itself in the water. When its prey happens to come near, the branches hook it, and draw it, as in a net, to the mouth. The arms are long and thin, and each springs from the body quite separately from its neighbor.

The body is made from a number of pieces fitted close together, with the utmost nicety. The mouth is surrounded by furrows or grooves, in which are some tiny holes. Through these holes, minute bodies, called suckers, can be pushed. They can take hold of any object, and keep it in a firm grasp, or they can help to retain the food of the animal while it is being digested. These star-fishes, with their snake-like arms, are very beautiful. Their bodies are all kinds of tints and hues, and it is very seldom that two of them are alike. But the whole race of brittle star-fishes give the naturalist a great deal of trouble. The creature

has the art of breaking itself up into pieces. The moment it is touched, or even approached, it begins to fling off, first one arm, and then another, till scarcely anything is left. Often the fisherman will bring up a number of these creatures in his net. They will twist about and put themselves into such strange attitudes, and fling their arms about them in so reckless a manner, that he will shovel them back into the sea. The naturalist, who wants to save a specimen for his collection, has

THE WONDERFUL OCEAN STAR-FISH.

but one way of proceeding. He must plunge the brittle star-fish into a vessel of cold fresh water. This will kill it at once, before it has time to get rid of any part of its body, and circumvent his efforts.

But even then the creature will often be too quick for him. He will slowly and cautiously approach, and lower his bucket of fresh water. But before he has time to do more, the brittle star will begin to break itself up. First will go one arm, and then another, till the naturalist will

seize hold of such parts as he can get, and carry them away, in despair of obtaining a more perfect specimen.

It is rather inappropriate to give the name Medusæ to the lovely fairy-like creatures bearing that name. For Medusa was one of the Gorgons. She was said, in the Greek mythology, to be a beautiful woman, with snakes growing round her head instead of hair. And, according to the same old story, whoever looked at her was turned into stone. The Medusæ here spoken of are a tribe of creatures that have all kinds of shapes, and wear all kinds of colors. They float about in the sea, and are as transparent, sometimes, as the water. Most of them, if not the whole of the family, have the power of shining in the dark, and they help as much as any other creatures to make the sea shine. When they are thrown on shore, they look like a mass of jelly or blubber. As the Medusæ have the disagreeable art of stinging very sharply, they are often called "sea-nettles." There is something very extraordinary in the history of these creatures. What animal life or structure can there be in a creature so imperfect? Let us look at it more closely, before we decide that question. Its body has nearly drained away. What is there left? A little quantity of transparent matter, almost like cobwebs, and full of cells. This is the framework or body of the creature, the only kind of skeleton it has. From the

THE FINE-HAIRED MEDUSA.

inside of the top disk there hangs down what might be a stem, divided into parts, and looking a little like the roots of a plant. The stomach, a very hungry one, is placed in the centre of this stem. The edge of the disk or umbrella is provided with long streamers of its own, that float about in the water, and are a little like the snakes of the Gorgon's hair. The opening to the stomach is the mouth, which is ready to receive whatever comes in its way. But the Medusa itself serves as food to the larger animals that live in the sea. The great whale feeds upon some species, for the family is very large indeed, and includes all kinds of varieties, in size, and shape, and structure.

One of the globe fishes is called Pennant's globe-fish, because it was discovered by a famous traveler of the name of Pennant. It has a crop a little like the crop of a fowl, which is one of its stomachs. When the

THE STRANGE COFFRE-FISH.

fish is alarmed, or in a passion, it puffs out this crop like a balloon. Then it turns over and floats on its back. While it is in this distended state it loses all power of guiding itself, and is drifted about at the mercy of the waves. But its prickles all stand up, so that it is really fully armed, and dangerous to any creature that approaches it.

When it wants to empty the air from its crop, it lets it off by degrees through the mouth and gills, making, as it does so, a rushing kind of noise. The fish puffs its body out and makes it a very odd shape, a little like a box with a lid to it. This is why it is called by the French the "coffre-fish." And it does not swim with its fins, as other fishes do. It seems rather to balance itself, and move from side to side, like a boat on the sea. The horny spines over its eyes and upon its back have a touch of poison in them. And in many instances the flesh of

the fish will be poisonous as well. The natives of the countries where the globe-fishes are found, are careful never to eat them, and they warn strangers of their poisonous nature.

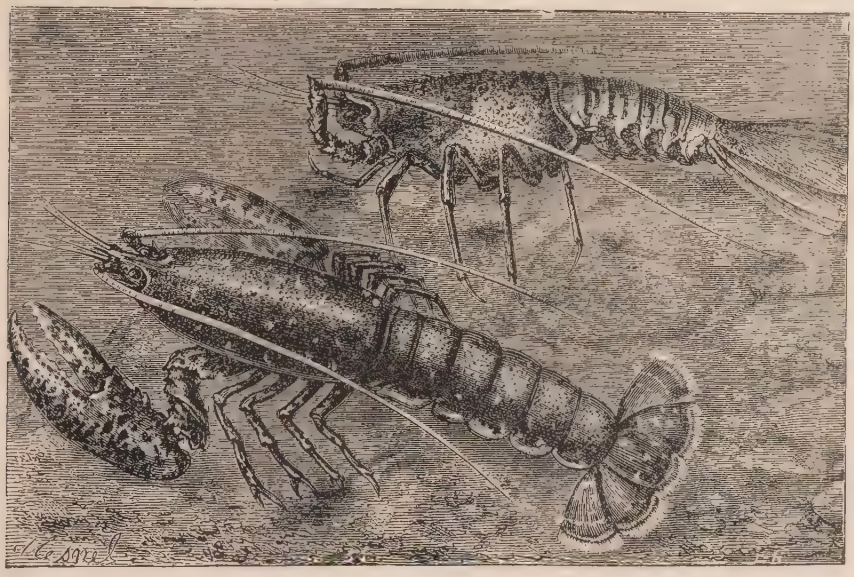
There is a story told of a sailor who was resolved to try, at all risks, and taste what the flesh of the fish was like. He thought it was only the curious shape of the fish that made it disliked. But when he had had the creature cooked, and had eaten it, he was taken ill and died, paying the penalty of his rashness and curiosity.

WONDERFUL CREATURES THAT WEAR ARMOR.

Nature does her work more skilfully than man. And she has made a whole race of creatures, who wear armor—armor that she has herself fitted upon them. Here we find shields, and bucklers, and lances, and spears; weapons, you perceive, as well as armor. It is a good thing these creatures are not very large, or else they would be dreadful monsters, and as dangerous as dreadful. They belong to a class in the animal world which is called crustaceæ. The name comes from a Latin word which means "to harden." They have rings round their bodies, as the annelides have. But the rings of these armed creatures are made of lime, and there is no soft flesh between them. There is either a piece of tough skin, or else the rings are close together, and form a compact case or shell.

One of the most familiar of these creatures is our friend, the lobster. He has a soft body under his hard shell, for we have eaten it, and know that it is rather a dainty to all those who have a taste for it. He has a famous shield on his back, and his legs are cased in armor, like the rest of his body, but there are joints or hinges, so that he can move them easily. His armor is neither too heavy or two clumsy for him. It fits him like a glove, and allows him to go about just as he pleases. The lobster's coat of mail is possessed by the creature soon after his birth; and here, rather a difficulty arises. As the lobster keeps on growing, in process of time the body of the animal becomes too large for his house. He is bound, and pent in, on every side. He leaves off eating, a sure sign that something is the matter. And he goes away and hides himself in some hole or corner. Here, he gets very thin, which is just the best thing he can do. His body shrinks away from the shell, and this makes what he is going to do more easy. Now begins the struggle The creature swells itself and wriggles about, till the old shell splits down the back and makes an opening. Then the claws burst at their hinges, and the lobster draws them off, as you would draw off a pair of boots. Next, the head throws off its covering or helmet, and then the body creeps quite out of the shell. The old shell lies complete in all its parts, and you might think the lobster was yet inside it. But

the lobster, with his armor gone, creeps into some safe place. His brother lobsters would soon eat him up, if they met with him in this defenceless state. So he takes care to keep out of their way. He is very tired and weak, and, now and then, a lobster dies during the struggle of getting rid of his shell. Nature will soon provide him with a new suit of armor. His thick skin becomes covered with a kind of glue, and forms a new shell. All he has to do, is to fill his body with water, and swell it out as much as he can. The skin directly begins to get hard, and the new armor forms itself into the same shape as the old. The lobster recovers his appetite, and comes forth with new strength and vigor, apparently none the worse for his transformation.



THE ARMOR-PLATED LOBSTER.

There is a family of crabs that nature seems to have neglected. The fore part of the body is armed, and has claws, but the hinder part has no covering at all. It ends in a soft tail. This creature cannot swim, like the rest of his tribe; and he cannot run. He seems to know that he is helpless, for he looks about to find some place of shelter. There are a great many shells on the beach. He picks out one that will do, and thrusts his tail into it. This serves him for armor. At first, he takes empty shells; but as he grows older, he gets more daring. If he sees a shell to his mind, he will not care whether it is empty or not. Indeed, he wishes for food as well as shelter.

As he prowls about, he will catch sight of a snail that has just put out its feelers. It draws them back in a hurry, the moment it sees the

crab, and tries to get into its house again. But the crab seizes it with his sharp claws, and drags it out and eats it. Then he marches into the snail's house, and takes it for his own. When the crab outgrows his house, he casts it aside, and sets about looking for another.

This hermit crab is very fierce and rapacious. But in spite of his fierceness, he often carries another creature on his back, and cannot get rid of it. The creature is one of those curious plant-animals, which are called zoophytes. The crab does not like to bear this burden, and makes great efforts to shake it off. But the zoophyte has fixed itself firmly on the shell of the hermit-crab, and sits there, quiet and contented until it pleases him to dismount and dismiss his steed.

THE HERMIT CRAB WITH HIS RIDER.

When a polyp lives alone in the sea, it is a feeble creature. United with its fellows, it is strong enough to build an island. Yes, and more than one island. Whole groups of islands have been made by the polyps. In the great Pacific Ocean there is a vast belt of sea, five thousand miles long, and fifteen hundred broad. This wide-spreading tract of ocean is studded with groups of the most lovely islands. They are called the South Sea islands. But another name is given them—Polynesia—a word meaning "many islands." By far the greater number have been built by the polyps. No rampart of the firmest rock could resist the action of the waves. It would in time be swept away and destroyed. Yet age after age the coral reef stands unhurt. It is, in

fact, a living barrier. Millions of little architects are always at work, and at hand to repair an injury.

The coral-making polyp has a vast number of relations. And these are at work, in their own way, in the fields of ocean. This lovely fan-shaped coral is a marvel of its kind. The lower end is fast to some rock under the water, and the fan itself is stretched out, as though some sea-nymph were about to use it. The fan is but another kind of living house, or houses, where hundreds of polyps dwell. Like a beautiful leaf, it waves gently in the water, its surface covered with star-like polyps, whose bright heads are gay with all kinds of colors.

THE MARVELOUS SEA-FAN.

When the sea-fan is alive, and is waving about in the sea, a thick jelly covers it, the polyps make their cells in the jelly. But when it is taken out of the water, and the jelly and the polyps are gone, only the framework or skeleton is left. It looks then like a dessicated leaf, and even in what is left it is a most wonderful construction.

There is a dull, yellow-looking thing, like a piece of sponge, or of sea-weed, that is often thrown on shore. You might easily pass it by, as though it had no beauty or interest. But put the ugly thing into a vessel of sea-water, and it becomes alive with starry-headed polyps! They push their tiny heads through numbers of holes. In fact, the

rough, ugly thing blossoms all over with these minute flowers. Each flower is a separate animal. If you touch the little heads, the polyps are frightened, and draw them in at once. Then the starry flowers vanish, and the coralline on which they live contracts, and has again the dull leathery look it had before. But when the little polyps have recovered from their fright, they push out their heads and suck in a quantity of water. Then the coralline swells out to more than double

A LIVING TREE—ALCYONIAN.

its size, and becomes quite soft and almost like a sponge. Its name is alcyonian, and it waves its streamers as ships' masts wave theirs.

Sometimes a ship, as she sails among the islands of the Tropics, meets with a terrible danger; the little workers in the sea have been doing mischief. They have been making a great stem, or trunk, like a tree. On the top of the stem are a number of lumpy knobs, and that is called a brain stone. The brain stones are covered with thick flesh

like jelly, in which the polyps live. The polyps are called madrepore polyps, and are only met with in the hot seas of the Tropics. They work so fast, and their stony houses are so strong, that it is not at all pleasant to meet with them. They fill up many a space over which a ship is going to sail. On comes the ship, and before the captain is aware, it drives upon a rock.

The brain stone has twisted lines, or ridges, all over its surface. The polyps have their cells between these lines, and live in them as in so many valleys. They throw out the lime that makes their cells in thin plates almost like sheets of paper. These plates, or layers, are arranged in a ray-like form round the middle of the cell, so that the madrepore head has a very curious effect. But it can only be seen when the structure has been raised to the surface of the water, and the polyps and the flesh-like jelly are gone. Then, the chalky ray-like heads are clearly visible. While the polyps are alive and at work, the madrepore rock or tree is gay with little rose-colored heads, that keep moving about, like flowers in the breeze of summer. The madrepore polyps build all kinds of fantastic shapes in these warm Tropical seas. Besides walls, and rocks, and trees, the structure will resemble a sheaf of corn, or a leaf, or a flower. There is no end to the strange devices of the little architects. The traveler on board a ship, will often gaze at these whimsical forms in wonder and admiration, as they glow, in all their beauty, beneath the waters.

THE CURIOUS BRAIN STONE.

The jaculator fish of Java is a fine marksman. A traveler saw several of these fishes in the possession of a Javanese chief. They were placed in a small circular pond, from the centre of which rose a pole upwards of two feet in height. On the top of the pole, on sharp-pointed pieces of wood, were placed insects of the beetle tribe. When the

slaves had placed the beetles, the fish came out of their holes and swam round the pond. One of them came to the surface of the water, resting there; and after steadily fixing its eyes for some time on a beetle, it discharged from its mouth a small quantity of water, with such force and precision of aim as to strike it off the twig into the water, and in an instant swallowed it. After this another fish came and performed a similar feat, and so the sport continued until they had secured all the beetles. If a fish failed in bringing down its prey at the first shot, it swam round the pond till it came opposite the same object, and fired again. The fish, in a state of nature, frequents the shores and sides of the rivers in search of food. When it spies a fly on the plants that grow in shallow water, it swims to the distance of five or six feet from them, and then, with surprising dexterity, it ejects out of its tubular mouth a single drop of water.

A few years ago, there was exhibited a wonderful "talking fish," as it was called, but it was, in reality, a seal. It measured twelve feet in length, and weighed eight hundredweight. It could stand on its tail, and overtopped its keeper. It was amphibious, and was a female seal. It was stated to have been captured on the coast of Africa. It had a fine dog-like head, and beautiful eyes, sparkling with intelligence, showing that what you said to it was understood, and seeking to communicate its reply. It was very docile, and would dance when bidden, rolling itself with great vehemence in its bath. It could say "Mamma" and "Papa," and could call its keeper by his name—"John." It could use its fins as hands and arms, and clasp them together in the attitude of supplication. At command, it presented either the right or left hand to the keeper. It was an Antartic species, and rare in museums. At night it reposed on damp boards, and the species can exist for days out of water; yet this specimen did not live long, and died much regretted.

WONDERFUL GRATITUDE OF A FISH.

When the late Dr. Warwick resided at Durham, the seat of the Earl of Stamford and Warrington, he was walking one evening in the park, and came to a pond where fish intended for the table were temporarily kept. He took particular notice of a fine pike, of about six pounds weight, which, when it observed him, darted hastily away. In so doing it struck its head against a tenter-hook in a post (of which there were several in the pond, placed to prevent poaching), and as it afterwards appeared, fractured its skull and turned the optic nerve on one side. The anguish evinced by the animal appeared most horrible. It rushed to the bottom, and boring its head into the mud, whirled itself round with such velocity, that it was almost lost to sight for a short interval. It then plunged about the pond, and at length threw itself completely

out of the water on to the bank. The doctor went and examined it, and found that a very small portion of the brain was protruding from the fracture in the skull. He carefully replaced this, and with a small silver toothpick, raised the indented portion of the skull. The fish re-

THE WONDERFUL SKELETON FISH.

mained still for a short time, and he then put it again into the pond. It appeared at first a good deal relieved, but in a few minutes it again darted and plunged about until it threw itself out of the water a second time. A second time Dr. Warwick did what he could to relieve it, and

again put it into the water. It continued for several times to throw itself out of the pond, and with the assistance of the keeper, the doctor at length made a kind of pillow for the fish, which was then left in the pond to its fate. Upon making his appearance at the pond on the following morning, the pike came towards him to the edge of the water and actually laid its head upon his foot. The doctor thought this most extraordinary; but he examined the fish's skull and found it going on all right. He then walked backwards and forwards along the edge of the

THE WONDERFUL SEA-PORCUPINE

pond for some time, and the fish continued to swim up and down, turning whenever he turned; but being blind on the wounded side of its skull, it always appeared agitated when it had that side towards the bank, as it could not then see its benefactor. On the next day he took some young friends down to see the fish, which came to him as before, and at length he actually taught the pike to come to him at his whistle and feed out of his hands. With other persons it continued as shy as fish usually are.

There is a singular race of fishes chiefly inhabiting tropical waters. They are eminently noticeable objects, if for nothing else, for the horns they carry, and for the numerous horny spines with which their bodies are studded. There is one family of them which has teeth arranged in the jaw like those of human beings, but the special class now under notice has, in lieu of fangs, a horny covering to its lips and palate enabling it with special facility to grind the sea-weeds, crustaceans and small molluscs, upon which it is thought to feed. The color varies in different sub-genera. The commonest is black on the back and on the greater part of the body, with yellowish belly, the horny spines, both distinct and associated as fins, being of the latter hue. Some of the fish have a large air-bladder, which they can inflate at will. This power of distension, forcing the fish into a large globular form, furnishes a formidable means of repelling attack. The body being so blown out, the spines stand forth stiff and bayonet-like, before which many an enemy quails. When distended, the fish floats belly upwards, and looks one of the most helpless things imaginable. Mr. Darwin met one on the coast of Brazil which was able to bite very severely, and to throw water from its mouth to a considerable distance. Darwin adds that it emitted from the skin of its belly, when handled, a most beautiful carmine-red secretion, which stained ivory and paper in so curious a manner that the tint is retained with all its brightness to the present day. Some of these fishes are known as sea-porcupines, and a few are taken occasionally on the south-western coasts of England. Their flesh, however, is worthless. They are valuable only as curiosities.

A MARVELOUS TRAVELING FISH.

Some fishes are endued with the faculty of living out of water—of being literally fishes out of water—with apparently the greatest ease. Some species bury themselves in the mud of the ponds in which they have their local habitation, but which are apt, in the dry season, to become waterless. Others have been met going in troops from the dry bed of their late pond to some other pond in the neighborhood. The most remarkable specimen of the kind, however, is the climbing perch. This curious creature has a peculiar formation of the upper part of its head, by which, in a number of cells, a supply of water is retained to moisten the gills of the fish when absent on its travels. Frequently it quits its wonted pond for a considerable ramble inland; and it has been found so remote from water as to induce the belief that it must have fallen from the skies in a shower. The conjurers of India and China exhibit it, of course attributing to their own magical influence the natural powers of the fish, thus practising an easy deception on the credulous.

The pearl is nothing more than a pellet, varying in size, composed of

the same shining, hard, calcareous matter, called mother-of-pearl, which lines the shells of many molluscs, especially those of the oyster and mussel tribes. They are found sticking fast to the lining whence they spring, or distinct in the bodies of the animals which produce them, lying loose in the substance of the animal itself, commonly in its thickest and most fleshy part. The cause of the production of the pearl is, in either case, some irritating influence acting upon the oyster itself. A

NATIVES OF CEYLON DIVING FOR PEARLS.

grain of sand has insinuated itself between the soft mantle of the oyster and the shell, and to get rid of the annoyance the animal throws over it some of the calcareous secretion which it has power to exude, adding thereto in proportion to the amount of inconvenience it continues to feel. The pearls found in the body of the oyster or mussel are supposed to be abortive eggs which the creature has tried to throw out, but which, remaining, have been coated with additional nacre in order to render them less uncomfortable. The Chinese have several ingenious methods

for making the pearl yielders produce artificial pearls. They introduce into the shell of the creature small irritating objects—beads, nuclei of mother-of-pearl, metal knobs, any small thing, indeed, which the oyster cannot by any means get rid of, but finding it there proceeds to coat over with pearl. In the course of a year the secretion has been so considerable as to sufficiently remunerate those whose labor has been expended upon it.

The deep water fishery—that is to say, the fishery in about twelve fathoms—is conducted now pretty much as it was conducted in Columbus' time. Men accustomed from their infancy to an amphibious sort of life, and trained to be expert divers, go down naked into the sea in order to pick up the marvelous pearl-breeders which lie at the bottom. In Ceylon the pearl-fishers go out in company in their boats. The divers take turn and turn about at plunging, and remain under water for a minute and a half to two minutes. Some of them are said to be able to stay down as long as five minutes, but this power is exceptional, and only to be acquired by long practice. Trained to the work from childhood, the divers go down, with the greatest intrepidity, to a depth of from four to ten fathoms. To assist them in their descent, they use a large stone of red granite, having the smaller end bored so as to admit a rope, which is thrust through it. When about to dive, the diver seizes this rope with the toes of his right foot, and with the left foot secures a network bag for his oysters. He then takes hold of another rope with his hands and is let down from the boat to his diving-ground, the stone helping to sink him. When at the bottom, he casts himself loose from the stone, picks up his oysters, and when ready to return, jerks the rope by which he was let down, and he is then hauled up, leaving the stone to be recovered by its own rope, while he is safe at the top.

THE GULF STREAM.

Among the wonders of physical geography, few are more interesting in their relation to this country than what is known as the gulf stream. This is an oceanic current of great extent, which takes its rise in the Gulf of Mexico, whence it derives its name. The peculiar formation and position of this gulf renders it a receptacle for the waters of the Atlantic, which sweep across the north-eastern coast of South America; and, on arriving in the gulf, they become warmed to a much higher temperature than is anywhere found in the surrounding ocean. The summer temperature of the waters in the gulf is about eighty-eight degrees, while in the open Atlantic, in the same latitude, it is only seventy-eight degrees.

Thus warmed, the waters pass out of the gulf northward, in a deep and strong current, through the coast of Florida on the one side, and

the islands of Cuba and the Bahamas on the other. The stream progresses here with a velocity of five miles an hour. It rolls like a mighty river along the shore of North America, widening as it flows, until it nears the banks of Newfoundland, where it is turned aside, partly by the formation of the coast, which here projects boldly out, and partly by the encounter with strong and adverse currents from the North Atlantic. At the point where it is turned aside, it stretches almost across the Atlantic; the current itself, according to some, being about two hundred miles in width, and the warm waters of the stream extending in all more than twice that distance.

Crossing the Atlantic eastward, towards the islands of the Azores, the main stream gradually becomes lost and its current spent; but a portion of it continues northward towards the British Islands. The waters of the stream often bring cocoa-nuts and other tropical fruits to the shores of Europe. These warm waters mitigate the severity of climate to a considerable degree. While places situated in the same latitudes, both to the east and to the west, are frozen and comparatively uninhabitable during a large portion of the year, the British Islands, as a rule, enjoy a temperate climate; and this fact is attributed in a great measure to the beneficent influence of the warm waters brought down by the gulf stream. The peculiar verdure of the Emerald Isle, and the mildness of the seasons in its latitude, when Labrador and the regions round the Baltic are locked in ice, are the effects of an oceanic current which sets out more than four thousand miles away. And but for this, the river Mersey, which floats the commerce of England, would be frozen over during eight months of the year, shut against the world.

VOLCANOES UNDER WATER.

In November, 1867, a volcano suddenly began to show signs of activity beneath the deep sea of the Pacific Ocean. There are some islands nearly two thousand miles to the east of Australia called the Navigator's Group, and there had been no history of an eruption amongst them, nor had such an event been handed down by tradition. Most of the islands in the Pacific Ocean are old volcanoes, or are made up of rocks cast forth from extinct burning mountains. They rise up like peaks through the great depths of the ocean, and the top, which just appears above the sea-level, is generally encircled by a growth of the coral insect. Hence they are termed coral islands. These islands every now and then rise higher than the sea-level, owing to some deep upheaving force, and then the coral is lifted up above the water, and becomes a solid rock. But occasionally the reverse of this takes place, and the islands begin to sink into the sea, owing to a force which causes the base of the submarine mountain to become depressed. Sometimes

STARTLING EFFECT OF THE ERUPTION OF VERSUVIUS ON THE SEA.

they disappear. All this shows that some great disturbing forces are in action at the bottom of the sea, and just within the earth's crust, and that they are of a volcanic nature. For some time before the eruption, earthquakes shook the surrounding islands of the Navigator's Group, and caused great alarm, and when the trembling of the earth was very great, the sea began to be agitated near one of the islands, and vast circles of disturbed water formed. Soon the water began to be forced upwards, and dead fish were seen floating about. After a while, steam rushed forth, and jets of mud and volcanic sand. Moreover, when the steam began to rush up out of the water, the violence of the general agitation of the land and of the surface of the sea increased. When the eruption was at its height, vast columns of mud and masses of stone rushed into the air to a height of two thousand feet, and the fearful crash of masses of rock hurled upwards and coming in collision with others which were falling, attested the great volume of ejected matter which accumulated in the bed of the ocean, although no trace of a volcano could be seen above the surface of the sea. Similar submarine volcanic action has been observed in the Atlantic Ocean, and crews of ships have reported that they have seen in different places sulphurous smoke, flame, jets of water and steam, rising up from the sea, or they have observed the waters greatly discolored and in a state of violent agitation, as if boiling in large circles, with a tremendous fire beneath.

During eruptions of Mount Vesuvius, the waters of the bay of Naples are sometimes greatly agitated. The usually placid bay is made to boil, and throw up great clouds of mist and steam. This is a remarkable phenomenon attending volcanic action, showing its great power.

A WONDERFUL SOUNDING.

"They who go down to the sea in ships" do indeed "see the works of the Lord, and his wonders in the deep." Here is the narrative of a wonder told by one of those who was engaged for many years in a professional examination of the wonders of the ocean, and whose daily business it was to pry into the secrets of the great and mighty deep.

It seemed desirable to Captain Denham, when in command of the *Herald* on surveying service, to ascertain for himself whether he could not find a bottom to the bottomless sea. He chose a day when sea and air combined to produce such a calm as is seldom seen in the midst of the Atlantic, where he then was, half-way between Buenos Ayres and Tristan d'Acunha. Upon a great reel, rigged winch-fashion in the bow of the sounding boat, was the very deep sea lead line, one-tenth of an inch in diameter, and weighing, when dry, one pound per hundred fathoms. The plummet weighed nine pounds, was eleven inches and a half long, and one-seventh of an inch broad. Everything being ready,

the plummet was let go. The first hundred fathoms of line cleared out in a minute and a half; the second in two minutes five seconds; and the time for every succeeding hundred fathoms increased gradually; so that, whereas the first thousand fathoms ran off in twenty-seven minutes fifteen seconds, one hour forty-nine minutes and fifteen seconds was the time required to get out the seventh thousand. After seven thousand seven hundred and six fathoms, or eight and three-quarters English miles, had run off, bottom was reached; the operation having lasted nine hours twenty-five minutes. That bottom was reached there could not be any doubt, the extreme stillness of the water enabling the sounders to perceive the same indications of touch as would have manifested themselves with casts in much shallower water. Again and again the line was tried, and stopped always at the same mark; several sets of hands tried the line, and each verified the report of their predecessors. The beat of the lead on the bottom was as distinctly felt as if an electric shock had been passed through the line.

We marvel at the hen, which will lay two hundred eggs in the year, but the eggs of a fish must be counted by hundreds of thousands. In every mouthful, the whale swallows thousands of the tiny mollusk, which forms its chief nourishment. Frequently on the coast of Greenland, the sea is colored for ten or fifteen miles in breadth, and one hundred and fifty to two hundred miles in length, with tiny medusæ. A single cubic foot contains one hundred and ten thousand of these animals, and such a streak of color must contain at least sixteen hundred billion of them! Among specimens of the animal and vegetable life at the bottom of the Atlantic Ocean, in soundings along the telegraph plateau, were found beings which secrete many chambered shells, each the habitation of a group of individuals so minute as to require the highest powers of the microscope to perceive and describe them.

THE EXTRAORDINARY SEA-CUCUMBER.

The sea-cucumbers are extraordinary looking creatures, which vary in size from two or three inches in length, to more than a yard. They bear some resemblance to a cucumber, being a long worm-like cylinder open at one end. Their exterior is ruffled with little projections, which are usually armed with minute sharp hooks, by which the animal can hang on to foreign bodies for a few seconds.

Many of the species are able to produce from their external pores a most irritating fluid, which causes the hand that touches them to itch intolerably. But the creature posseses a most wonderful power; when from any cause it fears death, it can eject all its teeth, its stomach, its digestive apparatus, and reduce itself to a simple membranous sac. Doctor Johnston kept one of these animals in an aquarium; for some

reason or other he neglected to feed it, and when after some days he visited it, he found all its external apparatus thrown out on the floor of the vessel, and the holothuria itself was a shrunken, dilapidated and empty tube. Yet it was alive, and in three months had reproduced all its organs anew. Another singular property they possess is that of being able to divide themselves into two parts, each part becoming a separate creature. When this phenomenon is in progress, the middle of the animal begins to contract, and the extremities enlarge. This goes on until the centre is but a thread; at last it snaps, and forms two distinct creatures, which in time furnish themselves with all the necessary organs, and thus this curious creature is reproduced and multiplied.

WATERSPOUTS AND THEIR FREAKS AND DEVASTATIONS.

Waterspouts are among those curious phenomena of nature which have long been the subject of discussion with scientific observers, without any definite conclusion being arrived at as to their origin. Appearing in all countries of the world, they have attracted much attention and speculation, but no theory yet started to account for them has met general acceptance. Some have ascribed them to whirlwinds, others to electrical origin, and others, again, to a combination of both these causes. They are usually seen at sea in windy and cloudy weather, but occasionally appear in inland districts. In the latter case, however, there is generally water in the locality in the form of lakes and rivers.

Waterspouts at sea are usually formed in the following manner:—A dense cloud is seen to project from its centre a body of vapor, in form something like a sugar-loaf, with the apex pointing downward. This cone is agitated by the wind until it sometimes assumes a spiral form, and it gradually dips more and more toward the sea. As it approaches the water, a similar cone is seen to form upon the surface of the latter, with the point directed upwards, and both the clouds above and the waters below are evidently violently agitated by the influence at work to produce the phenomenon. Suddenly the descending and the ascending cones of water or vapor meet in mid-air, and form one united pillar, which traverses the sea with great velocity. The junction of the two cones is generally accompanied by an electrical flash.

After continuing in this form a short time, the waterspout bursts, in some cases with terrific violence, and to the destruction of anything in the vicinity. Many a ship has been overwhelmed in this manner, and sunk in a moment, with all on board. In 1855, five vessels were thus sunk by a waterspout in the harbor of Tunis.

The number of pirates who infested the Spanish Main in the early part of last century was so large that it can hardly appear wonderful that two women should be found among them, of the same lawless and

daring character. Yet the story of the two female pirates—Mary Read, and Anne Bonny, is sufficiently remarkable to claim a place in our pages, and especially as we are able to give portraits of them, copied from an engraving published at the time they lived.

Mary Read was born in England. Her mother, who was married to a sailor, gave birth to a son soon after her husband had departed on a voyage, from which he never returned. When the child was about a year old, his mother left her husband's relations, and went to reside for a time with her own friends. The boy soon afterwards died, but his mother finding herself in need of assistance, took a little girl, the

THE NOTORIOUS FEMALE PIRATES. (FROM AN OLD PRINT.)

heroine of our story, dressed her up in boy's clothes, and passed her off on her husband's mother as her son. The deception was successful, and the widow was assisted with a weekly allowance, to ensure the continuance of which it was necessary that the girl, whose name was Mary, should pass for a boy so long as the old woman lived.

Mary was thirteen years of age when the old woman died, and being accustomed to her attire, she was not disposed to change it for the apparel proper to her sex. She first took a situation as foot-boy to wait on a French lady, then entered herself on board a man-of-war; after quitting which, she went to Flanders and carried arms in a regi-

ment of foot as a cadet. Failing to get a commission, she changed to the cavalry, and displayed such courage as to win the esteem of her officers. Her promising career, however, was now cut short by a circumstance which has often changed the fate of men and kingdoms —she fell in love with her comrade, and having made him acquainted with the secret of her life, they pledged troth, and when the campaign was over, were publicly married. Her husband, however, lived only a short time, and on his death, finding herself penniless, she resolved to resume her old manner of life; so putting on man's apparel, she went to Holland and joined a regiment of foot. But she was impatient of promotion, and finding herself one day near the coast, she seized the opportunity of embarking in a ship bound for the West Indies. It happened that this ship was taken by English pirates, who kept Mary amongst them, but soon afterwards took advantage of a Royal proclamation to surrender themselves, and live quietly ashore. This they did so long as money was plentiful; but after awhile, hearing that Captain Woods Rogers, governor of the island of Providence, was fitting out privateers to cruise against the Spaniards, Mary, with several of her comrades, embarked for that island, resolved to make a fortune one way or other.

We now come to the most extraordinary part of Mary's story. Some of the privateer crews, who had been pardoned for piracy, rose against their commanders almost as soon as they had sailed from port, and took to their old trade. In this number was Mary Read, though she afterwards declared that she had always abhorred the life of a pirate, and had resolved to quit it whenever the opportunity should offer. If she really felt this repugnance, it was not for want of courage, as no man in the crew with which she sailed was ever more ready to seize the boarding-pike, or undertake any hazardous adventure.

Anne Bonny was born in the County Cork, where her father was an attorney. He deserted his home, and emigrated to Carolina, taking Anne with him. Here she incurred his displeasure by marrying against his will; and being turned out of doors, found her way to the island of Providence, where she made the acquaintance of a pirate captain named Rackam. On board his ship she fell in with Mary Read, who soon found it necessary to reveal to her the secret of her life. It was natural, after this, that the two women should be often together, and this intimacy excited the jealousy of Captain Rackam, who was so violent that he would have killed Mary if her secret had not been discovered to him also. Then they continued their cruise in harmony, and captured a great number of ships belonging to Jamaica, and other parts of the West Indies, bound to and from England.

Between this period and the capture of the pirate ship, an incident occurred which shows in a striking manner the courage and devotion of which Mary Read was capable. Among the captives taken by the pirate captain was a gentleman of such attractive manners that Mary could not help falling in love with him. It happened that he had a quarrel with one of the crew, when the ship was lying at anchor, and a time was appointed for the two men to go ashore and fight it out. Mary would not on any account have seen the man she loved shrink from danger, yet she could hardly doubt that his chance against her shipmate would be very slight. She accordingly made an occasion for quarreling with the pirate, some two hours before the time appointed for his duel, and fighting him with sword and pistol left him dead.

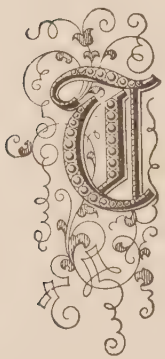
When the pirate ship was attacked by one of His Majesty's ships, and came to close quarters, only one besides Mary Read and Anne Bonny kept the deck. So gallant was Mary, that she called down to Rackam and his crew, when they fled to the hold, to come up and fight like men; and finding no response, she fired down amongst them, killing one and wounding others. On being asked by one of Rackam's prisoners what pleasure she could have in being concerned in such enterprises, when her life was continually in danger by fire or sword, and not only so, but she must be sure of dying an ignominious death if she should be taken alive, she answered that as to hanging, she thought it no great hardship; for were it not for that, every cowardly fellow would turn pirate, and so infest the seas that men of courage must starve. Anne Bonny also showed her courage to the last. The pirate captain having been admitted to see her, by special favor, on the day he was to be executed, she told him contemptuously that "if he had fought like a man he need not have been hanged like a dog."

About their ultimate fate there is great uncertainty. They were both condemned to be hung, but Mary Read died in prison, and Anne Bonny, having been respited from time to time, also escaped execution; but what punishment she received, and what became of her afterwards, is not on record. In taking leave of them, one can but wonder and lament that qualities so admirable in all, but more particularly in a woman, as courage and endurance, should be capable of the perversion which this story illustrates, among the many wonderful things pertaining to the ocean and the life of its navigators.

CHAPTER II.

SUBTERRANEAN WONDERS.

The Inside World—The Earth a Mass of Fluid Crusted Over—Marvelous Caves—Bone Relics—The Famous Mammoth Cave—Mysterious Caverns—The Splendid Star Chamber—A Cave with Human Bones—The Celebrated Luray—A Strange Bridal Chamber—Various Compartments—Astounding Limestone Formations—Exquisite Flowers in Stone—Fingal's Cave—Wonderful Coal-Beds—A Man Fifty Years in a Swedish Mine—Water Under Ground—Artesian Wells.



THERE is abundant scope for speculative philosophers in the matter of the condition of the interior of the globe, and there are a few facts which will assist any one in the investigation and in the effort of obtaining a correct notion on the subject. The crust of the earth, as far as is known to geologists, consists of the oceans and continents, with their seas and islands. The highest mountain may perhaps be nearly thirty thousand feet, but it is not larger than a grain of sand on a globe three feet across, and the deepest sea would be a very slight depression on the outside. If all the mountains and hills were levelled, and the whole of the land made flat, it would be one thousand feet above the level of the sea. But if all the deep oceans, shallow seas, and lakes were upon a level bottom, the water of the earth would just be fifteen times deeper than the land is high. There would be one thousand feet of dry land, and fifteen thousand feet deep of water.

When a thermometer is taken down very deep mines, and the temperature or heat of the top is noticed first of all, it will be found that as a rule the heat increases one degree for every fifty feet of depth. The deep wells of Grenelle, near Paris, which reach down eighteen hundred feet, are much hotter at the bottom than at the surface. Their heat increases one degree in every sixty feet of depth. If the heat went on increasing at this rate, water would boil at two miles deep, and at thirty-four miles deep iron would melt. In many parts of the world springs come up to the surface whose water is boiling; and it must be remembered that the great agent in all volcanic eruptions is steam, and that the lava thrown out is nothing more than solid rock dissolved at a great depth in the earth by steam pent up and intensely hot. In one eruption, Mount Hecla, in Iceland, threw up lava in such quantities that the whole bulk of it must have been as large as the highest mountain in

the United States. There must be, then, great lakes where the steam collects in the crust of the earth, so low down that the heat is enough to melt iron, and they must communicate with the volcanoes.

From this it is considered that as the centre of the earth is reached, the part under the crust cannot be fluid, for the pressure of such thousands of miles of substances one upon the other would make every fluid a solid. Water, if it reached down only three hundred and sixty-two miles, would be like quicksilver, and steel would be compressed into one fourth of its bulk at the centre of the globe. But the heat down there may counteract the effects of pressure, and the kernel of the globe may be a glowing fluid mass. A great philosopher—Mr. Hopkins, of Cambridge—calculated that the solid crust of the earth was eight hundred to one thousand miles thick, and that the rest was a liquid. We live on a shell which seethes and boils within.

WHAT WOULD HAPPEN IF THE EARTH WERE TO CRACK.

It is a reasonable supposition that the crust of the earth is made up of mountains, land, oceans, and flowing waters, sediments of old rocks, and vast lakes containing molten rocks communicating with volcanoes; that it forms but a small portion of the globe; and that all the rest is made up of a mass consisting of a vast number of metals and gas intensely hot and submitted to enormous pressure. This globe, five times heavier than water, and so hot within, is absolutely covered with eternal ice and snow at its poles, and the only proofs most of us have of the heat within are from hot springs and volcanic eruptions.

There must have been a time when the globe, generally speaking, was hotter than it is now, because as it rolls along it gives off some heat to space; and if this be true, at some time, long ages since, the whole world glowed with heat like any of those great meteorites that are often seen far off, and as the smaller shooting stars do that come closer to us. What may be the future destiny of the world is a question pregnant with interest. There are small bodies revolving round the sun that seem once to have formed a large one; and certainly, if ever a great crack were to open out in the crust of the globe, and the ocean should rush down, such an evolution of steam and explosive gases would result as would break up the world into thousands of pieces.

WONDERFUL CAVES.

Caves are mentioned very frequently in Holy Writ, and they were used as habitations, or as burial-places, by the earliest Hebrews. Some caves were made or dug out by those who required them, but most of the caverns and grottoes of the limestone rocks of the Holy Land were made by nature, just as they have been formed in other parts of the world. There are some caves in the island of Cuba formed out of a

white marble rock, and they are being gradually filled up in a most remarkable manner. The caves are inland, and are situated at least one thousand feet above the level of the sea, in the midst of dense forests. The snails, of which there are many kinds in Cuba, retire to the caves; and the water which drops from the roof of the caves on to the floor contains much carbonate of lime, a sort of chalk. When the water dries up it leaves the carbonate of lime behind, and it cements the shells together; and as this process goes on year after year, a layer some feet thick soon forms on the floor. Often lumps of the marble fall from the roof and are glued on to the shells. Multitudes of bats resort to the caves, often die there, and their bones are mixed up with the shells by means of the carbonate of lime. Besides this, at certain seasons of the year, the soldier-crabs, which live in the shallow sea-water and on the shore during part of the year, retire to the forests and caves. Every soldier-crab lives in a shell of some dead whelk or top, and when he moves he carries his house on his back. These crabs start from the shore in vast numbers, and they have been traced through eight or ten miles of forest, and up to the caves in the hills. There many die or desert their shells, pulling weaker fellow-soldiers out of larger and more comfortable ones. The floor, with its moist cement, ever ready to envelop everything upon it and to harden, soon begins to rise, and after many years the cave becomes filled with the substances just described, mementoes of ages long gone by.

BONE RELICS STOWED AWAY UNDER GROUND.

What has rendered many caverns celebrated is the extraordinary collection of bones and teeth found in them, all jumbled together and cemented by the same kind of carbonate of lime noticed in the Cuban caves. Now the water which dripped from the roof of the cave must have come through the limestone rock either by means of cracks, or simply by filtering. It is found that rain-water often collects within itself the gas called fixed air, or carbonic acid gas, and when this is the case the water can dissolve small quantities of limestone. When once a crack occurs in a limestone rock opening on the surface, the rain flows down, and gradually eats away the rock; when the opening becomes large enough, a stream flows down and finds its way out, taking away more of the rock, and forming gradually a long system of passages, large caverns and tunnels. It appears that most, if not all, extensive limestone formations contain caverns, some of which are of great extent, and have long been admired for the brilliancy of their stalactites, and the pillar-like forms which they present. The island of Crete contains a great cavern, which has long been the wonder of travelers; and throughout the whole island, there is a world of marvelous caverns.

Kirkdale Cavern, in which such quantities of organic remains were found, is situated in Yorkshire, England. It was first discovered by some workmen in 1821, its mouth being then nearly concealed by stones and earth. On removing these, and exploring the interior, there was found a cavern, two hundred and forty feet in length, fourteen feet high, and from seven to three feet wide. The rock being of limestone, its roof was covered with hanging stalactites, and its floor, in many places, incrusted with stalagmites. The floor of the Kirkdale cavern was covered with a coat of soft mud and loam, about a foot thick, and in this were found the bones of various animals. These were in a high state of preservation; and, though broken, none appeared as though they had been worn by the action of water or sand, which would probably have been the case had they been drifted there in the naked state. The genera of animals to which the bones in this cavern belonged, amounted to twenty-three in number, viz: hyena, tiger, bear, wolf, fox, weasel, ox, elephant, rhinoceros, hippopotamus, horse, deer (three species), hare, rabbit, water-rat, mouse, raven, pigeon, lark, duck and partridge. A great proportion of these animals belonged to species now supposed to be extinct, though the genera of them all are still existing.

A DEN OF RAVENOUS HYENAS.

On examination of all the circumstances, Doctor Buckland came to the conclusion that this cave was once a den of hyenas, and that the multitude of bones thus discovered were carried into this place by these animals, and therefore that the hyena, an animal now inhabiting only the hottest climates, once lived in England. These bones were, without exception, broken or gnawed, so that among the vast numbers the cave contained, there could hardly be found all the pieces of a single limb, much less an entire skeleton. The great number of hyenas which had died in this cave, or whose skulls had been carried there, was proved by the great number of canine teeth which it contained.

Doctor Buckland supposes that the contents of these caverns are due to two causes: to the deaths of the prowling animals which inhabited them, and to the bones of other animals, which these brought home for food, and this undoubtedly is the true theory. The elephants and other large animals which do not inhabit caverns, and whose bones are found in them, must obviously have been conveyed there in detached portions; and since the bones of hyenas are found with them, and it is known that these animals carried their prey to such secret places, it is an obvious conclusion that such were the means by which, in a long series of years, such quantities of osseous fragments were accumulated.

The Mammoth Cave is the largest known to exist in the crust of the globe, and is situated in Kentucky. It is entered from the banks of the

Green River, a tributary of the Ohio, and appears itself to have been excavated by some ancient river in some long by-gone age of the world. It consists of a succession of caverns of various dimensions, with intervening passages, and has been penetrated by the curious explorer to a distance of ten miles.

Choosing, and accompanied by, one of the guides, you enter this underground region, and, descending some sixty paces, find yourself in a lofty cavern, or rather gallery, sixty feet wide and half a mile long, which, in consequence of the millions of bats which cluster here, is called, after the great ornithologist, the Hall of Audubon. This gallery is

WONDERS OF THE MAMMOTH CAVE, KENTUCKY.

chiefly remarkable for its length, its level floor, and the saltpetre wrought out of it in the beginning of the present century. Arrived at the further end of it, you find you have been conducted by it into a spacious amphitheatre, not inaptly denominated the Rotunda, one hundred feet high and one hundred and seventy-five feet wide, and from which branch off in various directions numerous corridors. Entering by one of these, you are led down a pretty rapid slope into a chamber three hundred feet in circumference, the lofty roof of which is arched like the nave of a cathedral, and supported, as it were, by stalactites resembling cathedral pillars. This cavern bears the name of the Gothic Church, which,

that the resemblance might be complete, Nature has provided with stalls and even a pulpit, whence, it is said, once and again, Christian ministers have preached the gospel. The pillars and pulpit have been formed, in the course of long ages, by water dropping continually from, or rather through the roof, charged with particles of lime and flint, which, as they adhere at the top, depend like icicles, or harden at the floor rise into columns. Such formations, when suspended from the roof, are called stalactites, and when rising from the floor, stalagmites; and these often result in producing forms strongly similar to those organized by living nature and elaborated by art. In this case so complete is the similarity to a gothic church, that eyes, aided by torch-light and imagination, have discerned here an altar, a font and candalabra, nay, even an organ flanked by draped figures in various attitudes.

A FRIGHTFUL CAVE STREWN WITH MUMMIES.

The avenue called the Gothic—as being no less rich in fantastic shapes, borrowed, as it were, from the gothic model—by which you retire from the church, conducts, through a succession of corridors, into what is called the Chamber of Ghosts. This compartment of the cave is so named because of the immense number of mummies found in it when it was first explored; the only relics it is thought, of a tribe of Indians long since vanished from the earth.

Quitting the Chamber of the Ghosts, your way becomes narrow, tortuous and often steep. First, you descend by a series of ladders, then you cross a chasm by a wooden bridge of the most frail, rickety structure, and are soon involved in the coils of a labyrinth winding and again winding upon itself. At length the passage grows straighter indeed, but the roof lower and lower, until not even stooping will suffice, and you must go down and creep along on all fours. This passage, called the Valley of Humility, terminates in a sort of balcony, to which has been given the name of the Devil's Chair. This chair is a recess cut out in the side of a perpendicular rock, and provided with a window, from which you look down into an abyss deemed by witty people not unworthy of the name they have given it, the Bottomless Pit. The wall in which the balcony, or chair, has been formed is one of the sides of this pit, and is doubtless the brow of the precipice over which once dashed the waters of some extinct Niagara. The abyss yawns gloomy and vacant in the lamp-light both above and below, only darkness visible all round. Bits of paper twisted and dipped in oil, are kindled by the guides, and thrown in, but they keep falling as long as they continue burning, and seem no nearer the bottom when they go out than when they were lighted.

From the verge of this horrid gulf your guides next conduct you,

by a succession of ups and downs, to what they call the Mammoth Dome. This is a cavern of immense extent, with a cupola, or dome-like roof, nearly four hundred feet in height, and the vault of which is lost in so dense a darkness as to be invisible even under the light of multiplied torches. A stone of even moderate size, detached from this roof, would, you are told, quickly despatch you, if you happened to be below it, an announcement under which you feel no inclination to tarry longer, and you willingly follow your guide as he precedes you by a path which rises winding to the summit of this dome. Arrived at its lower margin, you look up, and lo, you behold a vault, dark as night, studded all over with star-like fire. This, your guide tells you, is the Star-chamber, while you, as you gaze up, can hardly persuade yourself you are not standing under the firmament of night itself. Being incrusted all over with stalactites of black gypsum, this dome, when illuminated by the lamps of the guides, sparkles like the midnight sky.

A ROLLING RIVER IN THE AWFUL DEPTHS.

Passing from the Star-chamber, you skirt the shores of a lake some fifty feet long and thirty feet broad, which you are gravely told is the Dead Sea; and, by-and-by, you stand arrested on the banks of a river you are assured is the Styx, which, especially when you descry the boat at its margin, reminding you of Charon, you feel half disposed to believe it is. It rolls on, at a depth of three hundred feet below the earth's surface above, in a volume of water forty feet deep, and about five hundred feet onwards dives suddenly out of sight, veiled in its going, as in its coming, like the mystery of life itself. After sailing on this nether river, in which, by the way, you are told anglers have caught two kinds of fishes, one with eyes but without vision, and another with no eyes at all, only marks, you disembark at length at the further end on a bank of fine sand, where you can clearly perceive traces of higher water-levels. Onwards a little further you alight upon a small sulphur-spring, and then by the Cleveland Avenue, whose walls seem wrought all over with a delicate fretwork of flowers, you are at length ushered into what, from the snowy whiteness of its walls, obtains distinction among entities as the Snow Ball-room. From this, by paths now wide, now narrow, now smooth and level, now steep and rugged, you pursue your way, and arrive at length at a range of rocks lying athwart your course, which you see must have fallen detached from the vault above; and as you ascend and descend, you are given to understand are nothing less than the Rocky Mountains. These you cross, not merely for the sake of crossing, but to see the far-famed Fairy Grotto which lies beyond. This grotto, when you enter and inspect it, you find a fairy-realm of pillars and arches which, as the sonorous drippings all

round testify, are still unfinished, and not to be seen, therefore, or criticised by fools or children, who, according to a Scotch proverb, should never see things half done.

At the further extremity of this room, as it is called, a group of stalactites may be seen, which, in their curvings and inclinations, are an exquisite imitation, as in alabaster, of an Oriental palm-tree, from the top of which the jet is still in play, under whose droppings and runnings this glittering arabesque is being formed; and this, as you behold it with still fresh wonder, your guide, to your sorrow or not, announces as the close of the entertainment. Thus far, it seems, you have penetrated to a depth of above nine miles; and your journey hither and back, you need not be astonished should it occupy ten hours;—ten hours which, whether marked with white chalk or black on the tablet of memory, are not soon to be forgotten, and likely to form a period to or from which all other events in your history may date themselves.

The account of the terrible experience of an excursion party gives some idea of the vast recesses of this underground world. During the evening, while the party were traveling through the winding passages beyond Echo river, nine of them, who were in the rear, became separated from the main body. The only guide was at the head of the line, and the absence of the rear guard was not noticed for some time. The unfortunates were lost for eight hours in the intricate underground mazes of the mighty cavern. From one till nine o'clock at night they wandered about aimlessly but constantly getting further away from the main track. To add to the terror of the situation, their lights went out, leaving them to wander on in the darkness and dangers of the cavern. The wanderers finally adopted the plan of leaving small articles of clothing in their path as they walked along, and by these means they were finally found by the party of friends who were sent in search of them sitting on the banks of Echo river, to which they had finally arrived. The ladies in the party suffered greatly from nervous excitement, and the excursionists were completely exhausted by the time they got back to the hotel. It was such an experience as they would not wish to repeat in this underground world, although so marvelous.

THE WONDERFUL LURAY AND ITS CAVERNS.

Hidden in the woods near the top of one of the Appalachian hills, about a mile east of Luray, West Virginia, an old cave has always been known to exist. It was not until 1878 that it was completely explored, and now it is one of the wonders of the world, and thousands of people visit it every season. From the narrative of a visitor, a description is given of its marvelous caverns, grottoes, and formations

The guide opened an inner door and invited us to follow him down a staircase of masonry, and, before we supposed our day's adventures had begun, we found ourselves in the large antechamber of the caverns. This unpremeditated, unintentional entrance is as though you had been dropped into the midst of it, or had waked from a sleep there, and is most effectual in putting the stranger in sympathy with the spirit of the place. The darkness was only faintly illuminated by our few candles, and I was about to remonstrate, when the click and flash of an electric arc, flooded the whole place with light. Our few candles were intended merely for peering into dark corners and helping our footsteps—the general illumination is accomplished by dozens of electric lamps hung in all parts of the wide-winding vaults and passages. Thus every important part of the cave is illuminated.

This first chamber is about as big as an ordinary barn, and from it we proceed upon a causeway of cement for a short distance past the Vegetable Garden, the Bear Scratches, the Theatre, the Gallery; over Muddy Lake on a planking bridge, which is itself spanned by a stone arch; through the Fish Market and across the Elfin Ramble—a plateau in which the roof is generally within reach of the hand; and so come to Pluto's Chasm, which is quite as dismal as its name indic tes.

HOW THE CAVERNOUS WONDERS ARE FORMED.

Great caves can only occur in a limestone region, since they result from the chemical fact that carbonates of lime and magnesia are soluble in water containing carbonic acid. This acid abounds in atmospheric air, and is one of the products of the decomposition of animal and vegetable waters, so that rain-water which has percolated through the soil has usually been enriched with it from both sources. Let this chemically charged water find its way into some crevice, and it only requires time and abundance of water to dissolve and hollow out Pluto's and all the other chasms, halls, galleries and avenues; and when once this work has well begun, other natural agencies contribute their aid to enlarge the area and adorn its interior.

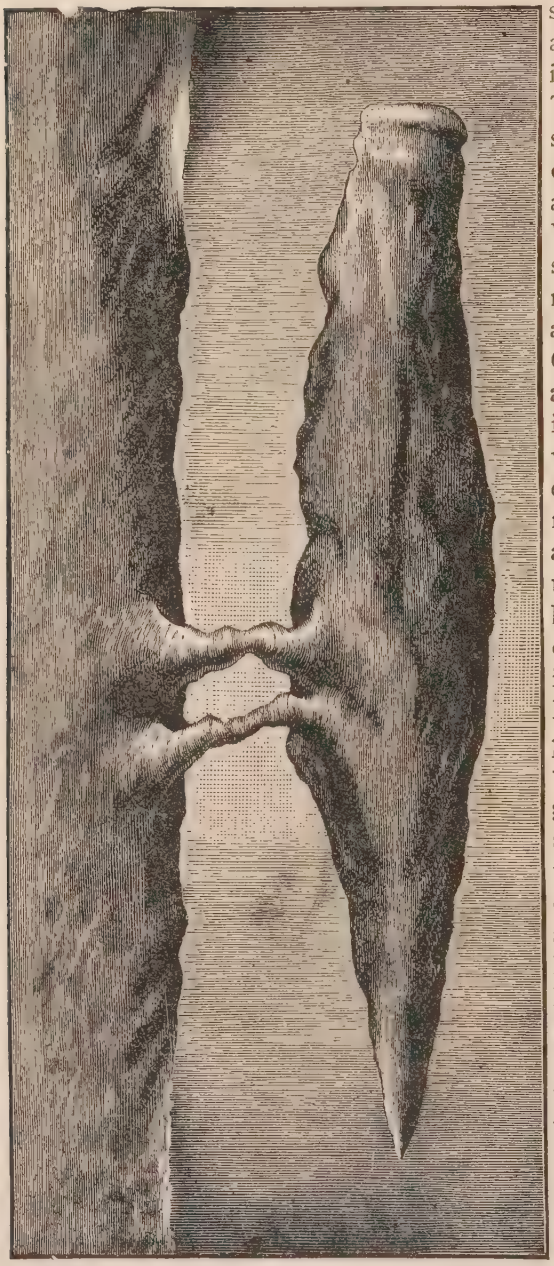
From the chasm, where there is a Bridge of Sighs, a Balcony, a Spectre, and various other names and habitations, we re-cross the Elfin Ramble, pass successively Titania's Veil, Diana's Bath, and come to a very satisfactory Saracen Tent. Then we ascend stairways, pass the Empress Column, and proceed under the Fallen Column to the spacious nave of the Cathedral. We pause to note its lofty groined roof and Gothic pillars—surely, in some like scene to this, the first architect of that style met his inspiration!—its large, Michael-Angelesque Angel's Wing, and its Organ. Then we sit down and turn to the prostrate stalactite. It is as big as a steamboat boiler, and bears an enormous

pagoda of stalagmitic rock which has grown there since it fell. It thus forms a good text for a conversation as to the age and geology of the cave, concerning which there may be a great variety of opinion.

A GROTESQUE BRIDAL CHAMBER.

Leaving the Cathedral, a narrow, jagged passage, we get an outlook down into a sort of devil's pantheon, full of grotesque shapes and colossal caricatures of things animate and inanimate, casting odd and suggestive shadows in whose gloom fancy may work marvels of unworldly effect, and then are led by a stairway to a well-curtained room called the Bridal Chamber. The back door of the Bridal Chamber admits to Giant's Hall, just beyond which is the Ball-room—both large and lofty apartments, constituting a separate portion of the cave, parallel with the length of Pluto's Chasm. In the Ball-room we have worked back opposite the entrance, having followed a course roughly outlined by the letter U.

I have thus run hastily over the greater part of the ground open to the public, in order to give an idea of its extent and nomenclature. To describe each figure and room separately is impossible. But I can give some general notion of the character of the ornamental formation of crystalline rock which renders this cave without a peer in the world, perhaps, for the startling beauty and astonishing variety of its interior. Chief of all the varieties of stalactite, and the one that in lavish profusion is to be seen everywhere in these caverns, is that which, by growing on the edges only, produces not a round, icicle form, but a wide and thin laminated or sheet form, which is best described by its semblance to heavy cloth hanging in pointed folds and wrinkles, as a table-cloth arranges itself about a corner. Where ledges and table-like surfaces—of which there are many instances in the cave—are most abundant, there the "drapery" is sure to form. In the Market it crowds the terraced walls in short, thick, whitish fringes, like so many fishes hung up by the gills. The Saracen Tent is formed by these great, flat, sharply tipped and gently curving plates, rich brown in color, depending from a square canopy so that they reach the floor, save on one side, where you may enter as through conveniently parted canvas. The Bridal Chamber is curtained from curious gaze by their massive and carelessly graceful folds; the walls of Pluto's Chasm are hung with them as in a mighty wardrobe; Diana's Bath is concealed under their protecting shelter; Titania's Veil is only a more delicate texture of the same; Cinderella Leaving the Ball becomes lost in their folds as she glides, lace-white, to her disrobing; and a Sleeping Beauty has wrapped these abundant blankets about her motionless form; while the Ball-room carries you back to the days of the Round Table, for the



THE WONDERFUL CONICAL SHOT, LURAY.

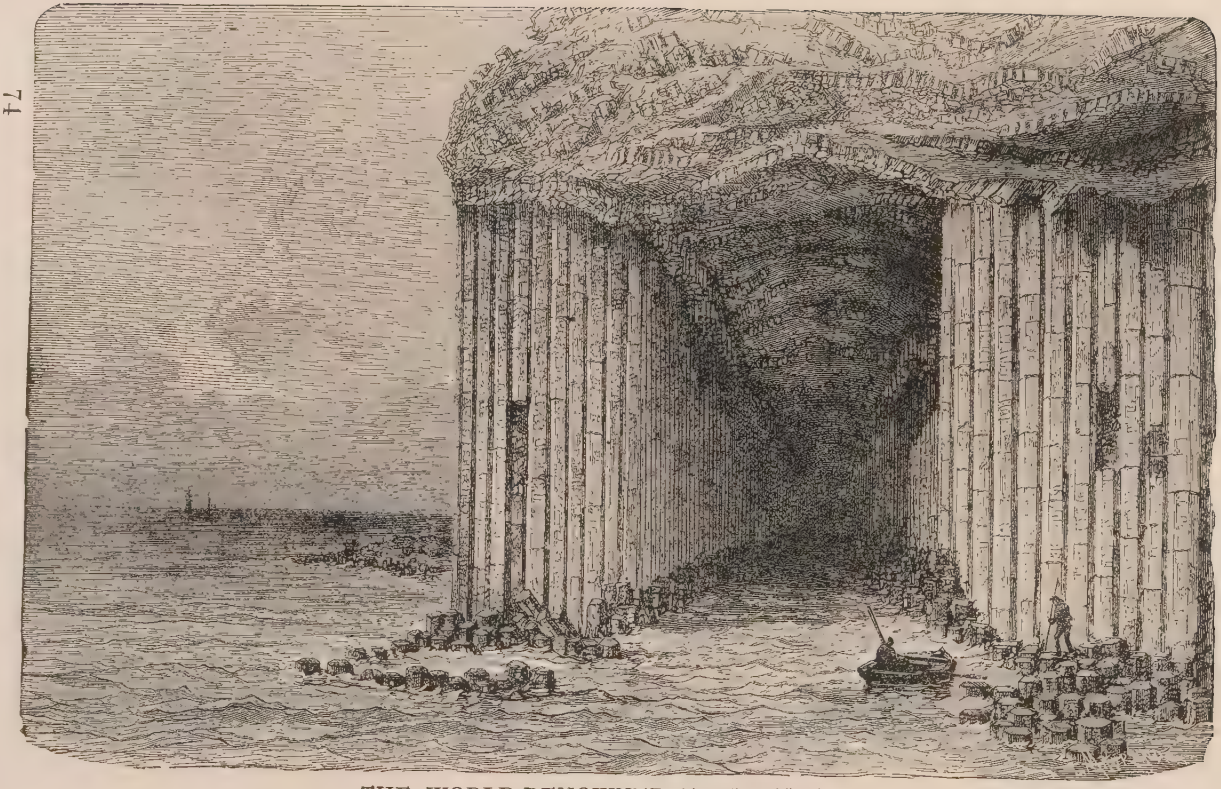
spacious walls are hung as with tapestries. There is also wealth of color. The range is small, to be sure, but the variation of tint shade is infinite and never out of tune. Where the growth is steady and rapid, the rock is crystal white as at the various Frozen Cascades, the Geyser and many instances of isolated stalactites. But when the steady growth ceases, the carbonic moisture of the air eats away the glistening particles of lime, and leaves behind a discolored residuum of clay-dust and iron oxides. Thus it happens that, from the pearly surface of the new work, there runs a gentle gradation through every stage of yellowish and whitish brown to the dun of the long abandoned and dirty stalagmite, the leaden gray of the native limestone, or the inky shadow that lurks behind. It is thus that the draped and folded tapestries in the Ball-room are variegated and resplendent in a thousand hues. Moreover, various tints are often combined in the same object, particularly in the way of stripes more or less horizontal, due

to the varying amount of iron, silica, or other foreign matter which the limewater contained from time to time. The best example of this, and, indeed, of the "drapery formation" generally, is to be found in the Wet Blanket, a very singular formation and much admired.

In more than the general effect the ornamental incrustations of this cave mimic the vegetable growths outside. Many of the stalactites are embroidered with small excrescences and complicated clusters of protruding and twisted points and flakes, much like leaves, buds, and twigs To these have been given the scientific name of helictites, and the grottoes of Stebbins' Avenue exhibit them to the best advantage. Then there are the botryoids—round and oblong tubers covered with twigs and tubercles, such as that cauliflower-like group which gives the name to the Vegetable Garden; these grow where there is a continual spattering going on. That rigid stone should lend itself to so many delicate, graceful, airy shapes and attitudes, rivaling the flexible flower of the organic world, fills the mind with astonishment and bewilders the eye. And when you have struck the thin and pendent curtains, or the "pipes" of the Organ in the Cathedral, and have found that each has a rich, deep, musical reasonance of varying pitch, then your admiration is complete.

The cave has not yet many human relics; but we must not forget to follow down a long stairway into a deep and narrow gulch, where the dampness and gloom is little relieved by anything to please the eye. At the foot of the staircase the guide drops his lantern close to a trench-like depression, through which a filmy brooklet trickles noiselessly. No need of interrogation—there is no mistaking that slender, slightly curved, brown object, lying there half out, half embedded in the rock, with its rounded and bi-lobed head, nor its grooved and broken companions. They are not fallen, small stalactites; they are human bones. Fit for the mausoleum of emperors, what a vast vault to become the sarcophagus of one poor frame!

Not alone are the Mammoth and Luray caves objects of world-wide curiosity and amazement. About eight miles distant from the western coast of Mull, and belonging to the Hebrides group, is the small and uninhabited island of Staffa. That it owes its existence to volcanic agency is evident from its composition, which is almost entirely lava and basalt, the columns of the latter substance being the principal formation of the island, and from which indeed it derives its name, Staffa being the Norse term for staves or columns. Numerous caverns are to be found in it, but the most celebrated of all, and to which the island owes its fame, is Fingal's Cave, or as it is sometimes called in Gaelic, Uamh an Binn—the Cave of Music, from a supposed hole in the rock



THE WORLD-RENOWNED FINGAL'S CAVE.

through which the water flows in and out with a harmonious sound. It lies on the southern side of the island, and it extends inwards about two hundred and thirty feet. Just before the entrance on the right or eastern side especially, the columns are broken and irregular, as if the waves had worn away the shafts and left the bases only; but the entrance itself is through an archway fifty feet wide, and about seventy feet high, surmounted by an architrave of another thirty feet, and which is supported on each side for the whole length of the cave by basaltic pillars of a greenish-black hue, wonderfully jointed, and of great symmetry and regularity. The pillars vary very much in the number of their sides, though the greater part of them have five or six. The roof is almost unbroken in its surface, and is composed here and there of smooth rock, and of the cornices, as it were, of columns broken away—sometimes singly, sometimes in clusters or bunches, from which hang stalactites, white, crimson and yellow. A yellowish-white substance resembling lime has gradually oozed out of the joints of the pillars, filling up the spaces between and defining sharply their angles, the whole forming a species of mosaic work. The pillars on the west side are about thirty-six feet high, rising up straight from the water—while those of the east are, by the raising of their bases eighteen feet, reduced to half the height, the elevation of the roof being the same on both sides. On the eastern side is a ledge—it can hardly be called a gallery—by means of which it is possible to reach the extremity of the cave, which is there twenty feet wide. Though the floor is the sea, and the depth of water at the mouth is eighteen feet, and at the other end nine feet, it is seldom prudent and often impossible to enter. The entrance being so wide, the tide makes its way in in an almost unbroken swell. Standing, however, on the ledge of rock already mentioned, it is a sight exquisitely beautiful to watch when the sun is shining, the light green waves rolling in with a loud boom, made louder by the echoes, scattering the spray to the roof, and washing the half-broken pillars on both sides, when they reach the wall of rock that bars their further progress, and contrasting their color with the dark red or violet rocks that form their bed, and the black columns of the walls varied here and there by the stains of lichens into bright green and red, orange and yellow.

One of the most note-worthy of all subterranean wonders is the sacred cave at Jerusalem. Palestine is a country remarkable for its limestone formations, and, as a consequence, hollow excavations abound almost everywhere. In ancient times these were frequently used as tombs, and names were given to them as we now give names to cemeteries. At Jerusalem may be seen a rock which tradition has always

associated with the last scenes in the life of Christ. Under this rock there is a large cave, which may have been used as a tomb in earlier times, and which is regarded with a peculiar veneration on account of the history connected with it. This remarkable rock and its underground excavation can not be far distant from the most sacred spot on the face of the earth. Over the mass of rock stands a tomb-like building, erected in some remote age of the past.

CAVE UNDER THE SACRED ROCK AT JERUSALEM.

That the hard, stony substance, coal, should have anything in common with wood, except that they both easily burn, seems at first sight very improbable. It is nevertheless true that they differ very little except in appearance; that their properties are nearly the same; and that, indeed, coal was originally formed of wood and other vegetable matter. Wood, peat, brown coal, jet and true coal, when subjected to examination by the chemist, by means of the retort, yield similar products, and are found to differ chiefly in the amount of oxygen which

has been given off from the older specimens, and in the smaller bulk into which they have been compressed.

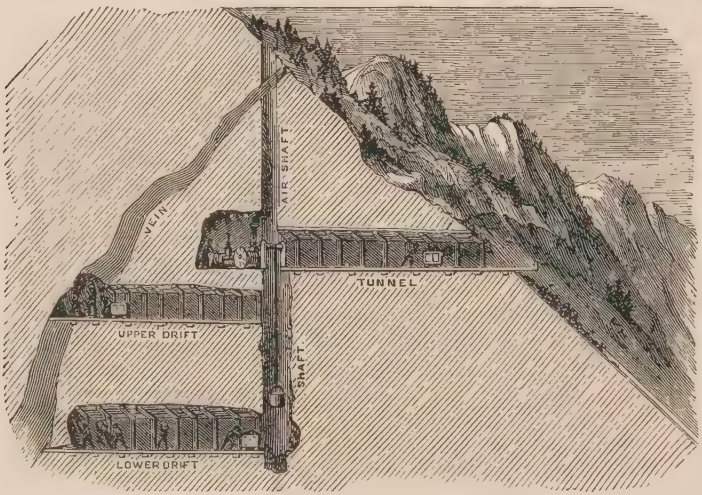
The substance of the coal, although entirely composed of vegetable matter, seldom contains fragments that can be recognized. These abound in the beds above and below the coal itself. The coal always rests on a bed of fine mud changed into stone, and called shale. This is generally much lighter in color than the other shales of the series, and it abounds in a fossil named Stigmaria, from the number of dots or pits all over the surface. This very common fossil was long believed to have been a water-plant, which, when it died, sank down into the mud, and was there buried and preserved. It is now know to be the roots of the great trees whose remains have chiefly formed the coal which rests on the shale, in which these roots are still embedded. They were large fleshy roots, and gave off numerous long cellular rootlets from the pits, with which they are completely covered. The soft structure of the rootlets and their great number, would enable the trees to withdraw a large amount of moisture from the soil in which they grew

FORESTS TURNED TO COAL.

The trees had a very singular aspect. They were straight, simple or branched stems, growing to a height of from fifty to eighty feet, entirely bare throughout the greatest portion of their length, but densely covered on the upper part with very long and slender leaves. The bare portion of the stem was marked with parallel flutings, and the elevated flattened ridges were ornamented with the impressions of the falling leaves, very regular, both in their form and arrangement in each species. The trees had an appearance similar to that of immense leafless cactuses, except that, instead of spines or hairs, the fossil bore true leaves. When, from a change in the level of the surface of the land or other cause, the coal was submerged, and gradually covered with mud or sand, these trees stood erect and were surrounded by the mud or sand. They withstood decomposition until several feet of the deposit was formed. These short trunks in the roof shale of a coal-mine are a source of serious danger to the miner, for when the coal is removed from below, the bed containing them dries to some extent, and the trunks, sometimes two yards in diameter and several feet high, easily separate from the rock because of the layer of coal which surrounds them, and often fall on the workmen.

A human body has been known to undergo a petrifying process similar to that which changes vegetable growths into coal. In the Swedish mines of Fahlun, while making a cross excavation between the shafts, some workmen discovered a corpse, so saturated with the vitriol, which is found in iron-mines, as to become, when brought into the air, as hard

as stone, though perfectly soft when first touched. For fifty years had the body lain three hundred feet below the surface of the ground in a pool of vitriol; and no one would have recognized the unaltered features of the unfortunate young man, no one would have remembered the circumstance of his having been lost (traditions of the neighborhood becoming confused, owing to the melancholy frequency of such accidents), had not the heart of a faithful woman identified the once beloved face; for when the inhabitants of the neighborhood, full of eager curiosity were pressing round to gaze on the recovered corpse, an aged gray-haired female, leaning on crutches, came up weeping, to the body, affirming it to be that of her betrothed husband, and blessing God for the day on which the gates of the grave had opened, to enable her to



VERTICAL SECTION OF A COAL-MINE.

look on him once more. The bystanders beheld with astonishment the re-union of this singular pair, of whom one had retained his youthful appearance in death, and in the bowels of the earth, while in the other the warm love of youth had remained true and unaltered, amidst the decay of her beauty and the inroads of old age upon her wasted exterior. Underground chemical forces are always at work.

One set of our coal-mines—or, as it is commonly called, a coal-field—is larger than half of the New England States, being seven hundred and thirty miles long and one hundred and eighty miles broad. The great value of coal arises from its power of producing a great amount of heat from a small bulk in a short space of time. The amount of heat that a pound weight of coal, set on fire in a good draught, will produce, is wonderful, and it can be measured by the warmth it will impart to a

kettle of cold water suspended over it. This heat is produced by the burning of the gases of the coal in the air of the atmosphere, and by the capacity for retaining heat which the solid part of the coal possesses. If a piece of coal be placed in the bowl of a pipe, and we then cover it with a lump of clay, and put it in a fire, leaving the end of the pipe outside, some steam comes off, and then a strong-smelling gas, which is the same as is burned in gaseliers. This gas can be collected by letting it bubble up through water into a vial full of water turned upside down. When all the gas has come away, if the bowl of the pipe be examined, what is called coke will be found instead of the piece of coal. Coal consists, therefore, principally of gas and coke, and there is besides a liquid which is produced during the gas-making, called coal-tar. Coke often looks like charred wood, and it is really so, for coal is altered wood and vegetable matter. When the mineral is brought up from the mine it contains impressions of fern-leaves and of trunks of palm-like trees. Some of these impressions are very beautiful, and geologists have studied, described and drawn no less than a thousand kinds of plants which have been noticed in the coal of all parts of the world, some of which are very much like plants now living in tropical climates. Large succulent trees are often found in the coal turned into that mineral, and their roots are still fixed in the clay beneath the layer or seam of coal. Besides leaves and fir-cones, many other vegetable matters are found, and they are frequently so well preserved that the microscope detects the delicate structure which characterizes them at the present day. Many animals and insects are found in the coal, such as huge toad-like reptiles with beautiful teeth, small tree-lizards, water-lizards, great fish with tremendous jaws, tiny water mites, a sort of snail, hundred-legs and many insects of the grasshopper and dragon-fly tribes. But none of these are of the same kind as those now living on the globe.

CHAPTER III.

WONDERS OF THE PACIFIC ISLES.

New Zealand—Rare Products—Tattooing—Strange Customs—Reception of a King—Volcanoes and Boiling Springs—The Bread Tree—New Caledonia—Superstitions—Dances—Coral Islands—New Guinea—Description of the Natives—Savage Fijians—Island of Tahiti—Excitement over a Horse—Sandwich Islands—Volcanic Eruption—Captain Cook and His Death—Surf Swimming—Pitcairn's Island—Singular Monuments—Handsome Marquesians—Island of Java—Marvelous Natural Beauty—Volcano—Animal Life—A Gem Set in the Sea.

NEW ZEALAND properly consists of three islands. The two larger, called North and South, are about as big as Pennsylvania. The little one, south of all, is too small to be of any importance. The fruits and flowers of New Zealand are endless in variety and beauty. Besides many beautiful trees and plants natural to the country, every sort of root and seed introduced by Europeans has grown and flourished, either in the North or South, in a wonderful way. In the North island, the myrtle and scarlet geranium bloom unsheltered all the year round; and grapes, figs, and melons ripen perfectly in the open air, and in the most northern parts, oranges, bananas, and pine-apples; but as tropical fruits of every description are to be obtained so easily from the neighboring South Sea Islands, it is not worth while spending the time in cultivating them.

In the fruit markets side by side with the products of the hottest climates, are gooseberries, currants, cherries and strawberries, which grow in the South Island in the utmost profusion and perfection. All vegetables thrive, as well as the kumera, or sweet potato, grown by the Maories, or natives, and so do our favorite American flowers—rose, honeysuckle, lavender, mignonette, even snowdrops, crocuses and daffodils. Our oak and elm and other trees grow well also; but for trees and flowers New Zealand was well off before the Europeans planted any there. A New Zealand forest in its native wildness is a most beautiful sight, with its infinite variety of pine-trees, evergreens, creepers, and shrubs. Many of the large trees bear lovely flowers, and the ground is carpeted with them. Among the most beautiful plants are the tree-fern and the cabbage palm, the most common is the manuka scrub, which grows all over the island. It is something like a myrtle, and has white, and

sometimes pink, blossoms. All the native trees, with one or two exceptions, are evergreen.

A rare kind of flax grows all over the island. The natives have always used it for all sorts of purposes, and it has a value in all countries on account of its quality. It has a very handsome large red flower, and has great sword-shaped leaves. It sometimes grows as high as seven feet, and in a heavy shower of rain a flax-bush makes a capital shelter. The Maories are very fond of sucking the honey which the flowers produce. Before the Europeans came, nearly all their clothing was made from this wonderful flax, not woven, but knotted together in a peculiar manner. The ordinary native dress is a garment of this material, nearly square, about five feet in length and four in breadth. It is fastened round the shoulders by two corners, and round the waist with a girdle. Over this they sometimes wear a large mantle covered with dog-skin. The dress of both women and men is the same. Their ornaments are feathers upon the head, and combs and pearl-shells. In their ears they wear pieces of jasper or green jade and sharks' teeth. The women adorn their necks with strings of sharks' teeth and a particular kind of berry. The feathers worn by the chiefs are considered of great importance, and in some way distinguish the different tribes to which they belong, being both useful and ornamental.

THE PRACTICE OF TATTOOING.

The process of tattooing, as practiced by the natives, is most painful and tedious. A preparation of charcoal is made and placed on a block of wood. Then incisions are made in the skin with a bone instrument dipped in the charcoal. The finer part of the work is finished up with a bone needle, more after the fashion in which sailors tattoo their arms with gunpowder. It used to be the universal custom to begin tattooing a wretched Maori boy at the age of ten, and continue the process at intervals till he was twenty. Many years ago a party of Englishmen were seized and tattooed by the Maories. One of them gives a terrible account of the suffering entailed by it. He was held down by six natives, and the operation lasted for four hours. The Maories themselves, however, do not seem to mind the pain of it, and tattoo their own persons, as well as those of their friends, with the greatest satisfaction. The tattooing of the face of a New Zealander marks the clan or tribe to which he belongs, like the stripes and color of a Highlander's plaid. Besides these distinguishing lines and curves, the intricacies and varieties of the pattern are like a crest or coat-of-arms, and mark the Maori chiefs from the common people, and also enable them to distinguish their enemies in battle. Besides the tattooing, they smear their faces with oil and red ochre, which is considered highly ornamental.

The Maories have many superstitions, some of which are most curious and others very silly and childish. One of the strangest is the "tapu," which means that a thing is sacred—not to be touched. The first missionaries often got into trouble by transgressing these laws unintentionally, and sometimes the Maories would lay traps for them, as it were, putting the sacred object in their way so as to give them an excuse for killing or injuring them. The chiefs are always tapu, especially their heads. Many places are tapu; birds and animals are sometimes tapu. In these days, however, the tapu is not nearly as strict as it used to be; the Maories will often take it off for money. When the Duke of Edinburgh reached the hot lakes in the North Island, the tapu was taken off the very sacred ducks which abound there, for his benefit; so that in such a case as this it really only amounts to a useful preservation of game.

A stranger custom than the tapu is what is called "muru." If any one has an accident or affliction, it is thought a compliment and a token of sympathy to visit him, eat up all his provisions, and sometimes rob him of everything he possesses. There is a very amusing old book called the "Pakeha Maori" (Pakeha means a stranger), which describes this custom of "muru" fully. A man's child fell into the fire and was nearly burned to death. The father was immediately plundered to an extent that almost left him without the means of subsistence—fishing nets, canoes, pigs, provisions, all went. His canoe upset, and he and all his family narrowly escaped drowning; some were perhaps drowned. He was immediately robbed, and well pommeled with a club into the bargain. He might be clearing some land for potatoes, burning off the fern, and the fire spreads further than he intended, and gets into the burial-ground. No matter whether anyone has been buried in it for the last hundred years, he is mercilessly robbed. For ten thousand different causes a man might be thus maltreated. Indeed, in many cases it would have been felt as a slight and an insult not to be robbed—the sacking of a man's establishment being often taken as a high compliment—and to resist the execution would not only have been looked upon as mean and disgraceful in the highest degree, but would have debarred the contemptible individual from the privilege of robbing his neighbor.

There were many worse superstitions and customs than these, however, against which the missionaries had to contend when they first took up their abode among the Maories. When a chief died, it was considered right and proper to kill a slave immediately, in order that the great man might have a spirit to attend him into another world. On one occasion, a young New Zealander died, the nephew of a chief,

who was staying at Sidney. The uncle chief immediately prepared to sacrifice a slave, to accompany the spirit of his nephew, and the missionary's family was only able to save the life of the poor fellow by hiding him. They persuaded the chieftain, with great difficulty, to give up the idea; but he was never thoroughly satisfied about it. He frequently lamented that his nephew had no attendant to the next world, and seemed quite afraid to return to New Zealand lest the father of the young man should reproach him with his neglect. When a chieftain died, one or more of his wives would always make an end to herself, in order that she might accompany her husband. In these days the wives content themselves with covering their heads, and howling and lamenting for days together. These lamentations and certain ceremonies and a great deal of feasting always accompany the death of a chief, and constitute what they call a "tangi"—a very curious custom.

A FRIGHTFUL WELCOME TO STRANGERS.

The first missionaries who visited New Zealand met with an enthusiastic reception, and the account pictures some of the interesting customs which prevail. As they landed, suddenly a woman came running towards them, waving a red mat over her head, and calling out "Haromai, haromai!" "Come hither, come hither!" This, they were assured was a friendly invitation. So they went forward, and soon found themselves in the midst of warriors and spears. Suddenly the warriors seized their spears, brandished them in the air, uttered the most frightful shrieks and yells, and flung their limbs and bodies about in the most horrible manner. This was, however, really only a compliment to the visitors, and was, in fact, a war dance of welcome. This method of showing pleasure at the presence of guests seems very strange, but other customs of the Maories are not less so. As it was a time of great rejoicing the Maories erected a huge platform eighty or ninety feet high, in the shape of a pyramid. The whole of the structure was covered with people, who literally swarmed upon it, and assisted in decorating it with colored cloths and streamers, and such ornaments as they could afford, giving it a very attractive appearance.

As evening drew on, all the party returned to the ship except two who determined to remain. They had supper of fish and potatoes in one camp, and then walked to another camp, about a mile off, where they were received quite as kindly, and were soon surrounded by chiefs. The first night passed among the natives was a strange one. The narrator describes it in this way: As the evening advanced, the people began to retire to rest in different groups. About eleven o'clock we wrapped ourselves in our great coats, and prepared for rest. The night was clear, the stars shone bright, and the sea in our front was smooth;

around us were innumerable spears, stuck upright in the ground, and groups of natives lying in all directions, like a flock of sheep, upon the grass, as there were neither tents nor huts to cover them. I viewed

A MAORI FESTIVAL—WELCOMING VISITORS.

our present situation with sensations that I cannot express, surrounded by cannibals who had massacred and devoured our countrymen. I wondered much at the mysteries of Providence, and how these things

could be. Never did I behold the blessed advantage of civilization in a more grateful light than now. I did not sleep much during the night. My mind was too seriously occupied by the present scene, and the new and strange ideas it naturally excited. About three in the morning I rose and walked about the camp, surveying the different groups of natives. When the morning light returned, we beheld men, women, and children asleep in all directions, like the beasts of the field.

INAUGURATING A KING.

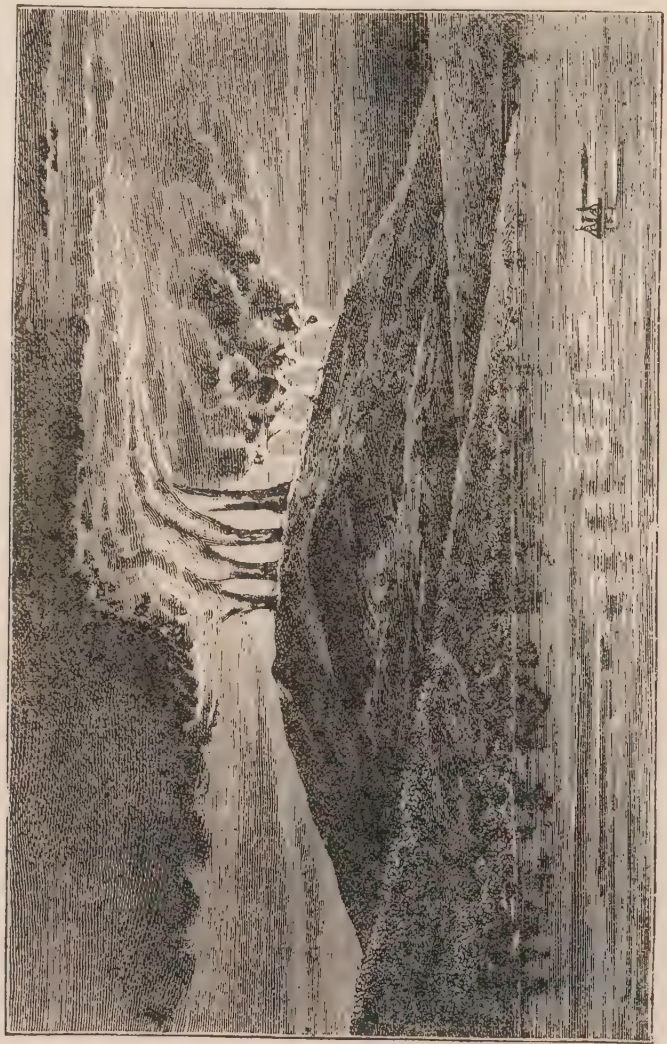
The account of the electing of this first king is very curious. In June, 1858, he was formally accepted at a place called Rangiawhia. He entered it preceded by his flag, bearing the device of a cross and three stars, with the name of the country in the centre. After him came the chiefs and numbers of well-dressed natives. He was received by a procession of the inhabitants of the place, one of the chiefs reading an address of welcome. A volley of musketry was fired by an army of young men, who then marched backwards and fell into lines, so as to form an avenue for the king to pass along, saluting him with another volley. The procession then advanced into a square formed by huts and tents, when at a given signal a profound obeisance was simultaneously made by all the assembly of the different tribes to the king. One of the native teachers then stood up and read a part of a chapter in the Bible, and gave out the verses of a hymn, which were sung. He then offered up a prayer. After a few minutes' silence a song of welcome was chanted by one of the chiefs, another volley fired, another obeisance made, and King Potatau was installed as the first king of the Maori race. He did not live long, and was succeeded by his son.

SPLENDID FORESTS AND VOLCANIC MOUNTAINS.

The forests of New Zealand are chiefly on the mountain ranges. The plains are covered with grass and fern. There is a grand range of volcanic mountains, which runs the entire length of the middle island, crosses the straits between the two islands far down under the sea, reappearing midway at the island of Shapiti. Many of the New Zealand mountains are of volcanic origin, but at present there are only two active ones—Tonganio, in the centre of the north island, and White Island, where the grand precipitous rock called the Sentinel Rock is dedicated to the memory of Captain Cook. The highest mountain in the northern island is a little more than ten thousand feet, but in the middle island there are higher mountains still.

Next to the mountains in size and beauty are the lakes. The largest of all is Lake Taupo, in the centre of the volcanic region in the north island. It is twenty-five miles long and twenty wide, and enormously deep—so deep that its depth has never yet been ascertained. This fine

lake has evidently been caused by the subsiding of the ground, as it contains great numbers of trees still standing up in its waters. In its centre rises a small and very beautiful island. Its water is as deep a blue as the ocean, and the native name for it, "Te Moana," means "The



A WONDERFUL VOLCANO, NEW ZEALAND.

Sea." The Maories believe that in the middle of Lake Taupo there is a whirlpool, inhabited by a "taniwha"—a gigantic kind of lizard, which seizes their canoes, whirls them round and round, and then devours them and their contents. There are quantities of small fish in the lake, which the natives catch, and cook in the convenient natural saucepans formed

by the hot springs near. They also use the steam and mud springs for stewing food. Visitors to this region always amuse themselves by cooking bacon, potatoes, and other vegetables, in these charming kitchens. On the south of Lake Taupo is the pretty village of Takanu, with a splendid waterfall near—three cascades, which come tumbling down rocks covered with woods and ferns. Some thirty or forty years ago, in this region, a whole village was buried; the hot springs had loosened the hill-side, then came heavy rains, and an avalanche of mud swept down over the village, and buried it.

THE MARVELOUS HOT SPRINGS.

The most wonderful part of the lake region is round the great hot Lake Ratomahana, which you recognize at once by the clouds of white steam rising from it. Everywhere round the lake there is a seething, hissing, and boiling sound from the numerous escapes of steam, boiling water, or hot mud. Eighty feet above, on the fern-clad slope of a hill, there lies an immense boiling cauldron in a deep hollow with steep sides, full to the brim of perfectly transparent water, looking bright turquoise-blue in its white basin. The surplus water flowing down the hill-side has formed a pure white deposit in a series of stages, each terrace hung with stalactites, and inclosing basins of every size and depth, the upper warmer, and the lower cooler—exquisite and most picturesque baths, the intense red of the bare earth walls contrasting with the blue of the water, the dazzling white of the basins, and the bright green vegetation round. The stone flooring does not cut the bather's feet in the least; it is quite soft to the touch, and smooth, so that you can recline in your bath in the greatest comfort.

BREAD THAT GROWS ON TREES.

New Caledonia is no less than two hundred and forty miles long; it is very mountainous, and has rather a bleak, barren appearance. The red clay soil is less fertile than that of most of the South Sea Islands, which is, perhaps, the reason that the inhabitants are more industrious than most of their neighbors, and have cultivated the ground more.

The bread-fruit, which is the staff of life to the natives of these islands, is indigenous in New Caledonia, but does not grow in the same profusion as in most of them. The South Sea Islanders have a curious legend with reference to the origin of the bread-fruit. They say, that in the reign of a certain king, when the people ate red earth, a husband and wife had an only son of whom they were exceedingly fond. The boy was weak and delicate; and one day the husband said to the wife: "I compassionate our son; he is unable to eat the red earth. I will die, and become food for our son." The wife naturally asked how he would become food; and he explained that he had prayed to his god to help

him, and had received a favorable answer. "When I am dead," he said, "take my body, separate it, and plant my head in one place, my heart in another, and so on. Then come into the house and wait. When you shall hear at first a sound like that of a leaf, then of a flower, afterwards of an unripe fruit, and at last of a ripe, round fruit falling on to the ground, know that it is I who am become food for our son." He died soon after, and his wife obeyed his directions. After a while she heard a leaf fall, then the large scales of the flower, then a small, unripe fruit, afterwards one full-grown and ripe. This was in the night. When daylight came, she woke her son and took him out, and they beheld a large and handsome tree covered with broad, shining leaves, and loaded with bread-fruit.

PREPARING THE FRUIT FOR THE TABLE.

The bread-fruit tree is certainly a most beautiful and wonderful one. The trunk, which is covered with a light-colored, rough bark, sometimes measures two or three feet round, and rises from twelve to twenty feet before the branches shoot out. Their form is very graceful, and the leaves are large, broad, and thick, of a dark-green color, with a surface as glossy as the most shiny evergreen. The fruit is sometimes round and sometimes oval; about six inches in diameter, and covered with rough rind, marked into lozenge-shaped divisions, rising in the middle. It is at first a light pea-green color, then it changes to brown, and when fully ripe becomes a rich yellow. The fruit hangs to the small branches of the trees by a short, thick stalk, either singly or in clusters. The flower is nothing particular. The fruit is never eaten raw, except by the pigs; and the natives have several ways of dressing it. When traveling, they often simply roast it in the flame or ashes of a wood fire, then they peel off the rind and eat the pulp. Sometimes they plunge it, when cooked in this way, into the water, and when soaked it becomes a sweet, spongy paste, of which the natives are very fond. The usual way of cooking it, however, and the best, is by baking it in an oven of heated stones. The rind is taken off and the fruit cut in slices, a layer of leaves is placed over the hot stones, and the fruit laid on it, another layer of leaves over the fruit, and hot stones on the top of them. The whole is then covered with earth and leaves, several inches in depth. In about half an hour the fruit is taken out nicely browned on the outside, the inside looking rather like the crumb of a white loaf. Plantains, sugar-canes, and cocoa-nuts also grow in New Caledonia, but in no great abundance. The natives cultivate them, as well as yams, with skill and care. There are plenty of fish on the coast, plenty of turtles, and a great variety of birds, some peculiar to the island; but quadrupeds seem almost unknown. There are no names for dogs, cats, or goats.

The natives are a tall, well-proportioned race of men. They have very frizzly hair, which is sometimes tied in a bunch on the top of the head, sometimes in two bunches, one on each side of the head, and very often cut short all round like a frizzly mop. The chiefs wear a sort of turban-like cap. The men wear scarcely any clothing, the women have a kind of petticoat.

Captain Cook, who was one of their earliest visitors, if not quite the first, gave them an excellent character. He described them as being most courteous and friendly, and not at all addicted to pilfering. He and his party were guided and accompanied in their excursions by natives who showed not the least fear of the white men, and never the slightest sign of hostility. Subsequent visitors to the island were not nearly so fortunate in their reception, but perhaps they did not understand so well how to manage the natives. Captain Cook had so much experience in making acquaintance with savages, and such a warm heart and genuine feeling of interest in them and honest wish for their welfare, that he generally succeeded in inspiring them with confidence and gaining their good-will. His death at last, at the hands of the Sandwich Islanders, was, as it were, from an accident; though a most sad one. Unprincipled traders, too, constantly removed the friendly feeling Captain Cook had established, and then, though they might themselves escape, woe to the next party who might visit the spot!

CHIEFS WHO CAN PUT THEIR SUBJECTS TO DEATH.

The New Caledonians are great fishermen, for, owing to the unproductiveness of their land, they have to depend on what they can catch as their principal means of subsistence. There is a kind of small fish something like a sardine, which comes in large shoals, on which the natives live a great deal. In the small rivers they catch eels and crayfish. Mullet are abundant, and on the beach plenty of shell-fish and molluscs of various kinds are to be found. The chiefs of New Caledonia are very great people: the natives approach them in a crouching position, and they have the power of life and death absolutely in their hands. They are very superior to the common people. Their gods are their ancestors, whose relics they preserve very carefully, and they pray to these gods before doing anything of importance—fighting, fishing, planting, or even feasting.

The spirits of those who die are supposed to go into the bush, and at certain periods of the year they have feasts in which they prepare heaps of food for them. They used to think the white men were the spirits of the dead, and brought sickness, and gave this as a reason for killing them. They have quite given up this idea now, but it is too true that the Europeans brought them many diseases of which they had never

heard before. On the death of a chief there are grand ceremonies of feasting and lamenting, and elaborate tombs are erected for them which are always kept sacred, and regarded with great veneration.

A PECULIAR KIND OF DANCE.

The principal amusement here, as in most of the Pacific Islands, is dancing. There is one very peculiar performance called the "pilou pilou." A party of travelers had paid a visit to the island, and were about to leave it, when they were dreadfully alarmed by seeing a long file of natives approaching, armed, tattooed and blackened, and brandishing their hatchets, their clubs, and their redoubtable lances; they came nearer and nearer, and at last placed themselves before the Frenchmen. At the same time two men seated themselves on the turf opposite the troops of warriors, one holding a flute and the other a hollow bamboo, upon which they began to play. The travelers at once recognized the festival sound, and their fears disappeared. It was a "pilou pilou," which the chief of the district was offering in their honor on the occasion of their departure. The principal attraction of the performance was a native ornamented with the New Caledonia mask. This is a frightful gigantic head of wood, at the mouth of which the man who wears it looks out. Human hair makes a great wig for it, and its lower part is surrounded by a net covered with birds' feathers. The native honored with the wearing of this advanced towards the spectators from the sea-shore by way of allusion to their arrival in the island. He danced a long time before his comrades, who accompanied him, brandishing their spears above his head, agitating their arms in time, and making a sort of panting whistle. After this exhibition the chief placed himself in front of the line, and made a sort of address to the departing guests, with long pauses now and then, during which the natives joined in an ear-piercing howl. The address was chiefly a series of good wishes and kind expressions to the Frenchmen, such as—"Our friends are going to leave us; they are going to set out to-morrow on the great sea. May the winds be favorable to them. May they find the sea calm and gentle, and arrive safe in port, after a pleasant voyage."

ISLANDS MADE OF CORAL.

About seventy miles from New Caledonia is a group of islands called the Loyalty Islands. They are formed of nothing but coral in an early stage of development, bare and broken ridges upheaved from the sea. Between them are pits filled with sufficient soil to cultivate cocoa-nut trees and yams, but the islands produce but a scanty sustenance for the inhabitants. Their chief-product is sandal-wood, which grows in abundance, and which brings the islands many visitors who trade with China in this article. Walking about the coral islands is dreadful work

for visitors: their shoes get cut to pieces and their feet exceedingly sore. A traveler who paid several visits to these islands describes one terrible walk of twenty miles; he says that nothing but broken bottles equals jagged coral. The paths are such that you never take three steps in the same direction, and every minute trip against blocks of coral hidden by long leaves and weeds trailing over the path. Often for half a mile you have to jump from one bit of coral to another.

From the observations of various travelers, it is evident that the coast-scenery of New Guinea on the south and east everywhere presents the same general characteristics—immense breadths of low, swampy land, densely planted with mangroves; which, as the ground rises, gives way to thick and lofty forests, inhabited by lories, cockatoos, and pigeons. Here and there sandy flats, uncovered at low water, are utilized by the natives, and weirs for catching fish are constructed upon them. These are walls of loose stones, about three feet high, formed in curves and semicircles, each with a radius of one or two hundred yards. At high water they are completely covered; but when the tide falls numbers of fish are left within these inclosed spaces, or, together with crabs and other creatures of the sea, caught in the interstices of the stones. At varying distances from the shore stretches the great sunken barrier-reef of coral, which possesses so marked a resemblance to the Barrier Reef of Australia. The water upon the reef is generally very shallow; but at certain points deep gaps or channels occur, which ships of heavy burden may navigate with safety.

FONDNESS FOR THE TOBACCO PIPE.

Along the low littoral belt clearings have been made by the natives, to obtain sites for their little settlements. For this purpose a slight knoll or rising ground is selected. The timber-trees are then felled, the old stumps and branches of the trees being sometimes left for the "ketai" or yam plants to be trained upon. In the rear a grove of cocoa-nuts frequently affords shelter and precious food. The gardens are planted with plantains, and fenced in with the bamboos; beyond which spreads the tropical forest, matted by innumerable creepers and impervious with dense undergrowth. The construction of the huts is always on the same system: a flooring raised upon posts, a gabled roof, and walls and partitions of split bamboo. The great amusement of the inhabitants of these huts—apparently their only luxury—is tobacco-smoking, in which they indulge after a fashion of their own. They break off a piece from the roll or plait into which the leaves are twisted, and wrap it in a green leaf, to prevent it from igniting the bowl of their wooden pipe. A woman is deputed to fill the bamboo tube with smoke; after which it is passed round, and each person in turn

inhales a long whiff, which he swallows, apparently with considerable effort—stands motionless a few seconds, as if paralyzed, with the tears in his eyes—then he respires deeply, and seems to recover. This practice the natives call "fire-drinking;" and objectionable as it seems to us, protest that it comforts and benefits them.

Their principal occupations are hunting, fishing, and manufacturing images, tortoise-shell masks, drums, and bows and arrows. The bows are made of the upper part of a stout bamboo, partly split in half, flattened, and bent by the application of heat. The string is a broad strip of the tough outer rind of a bamboo; and the fastenings are ingeniously and powerfully wrought. The bows are large, and of great strength; some are more than seven feet long, and in the centre more than three inches wide, and an inch thick. The natives discharge their arrows to very considerable distances, but not with any great accuracy of aim. The arrows vary from three to five feet in length, the common sorts being pointed only with hard wood, variously jagged and barbed. The war arrows, however, are much larger and heavier; the hard-wood part being very thick and square, and elaborately carved, with a sharp bone point and barb made and fitted like the Australian spears. The shaft is always a light cane or reed, without feathers. In using the bow, the men wear on the left arm a stout armlet or gauntlet, which reaches from the hand to the elbow, is made of woven grass, and serves to defend the arm from the rebound of the string, thus preventing the injury that otherwise would result.

PHYSICAL CHARACTERISTICS OF THE NATIVES.

A few words may be added in reference to the physical character of the natives, which will apply to all the Papuans, whether inhabitants of New Guinea or of the islands that fringe its shores. The men, generally speaking, are fine, active, well-made fellows—such is the description of a modern voyager—rather above the middle height, and of a dark brown or chocolate color. Sometimes their faces may be designated handsome; they have aquiline noses, rather broad about the nostrils; well-shaped heads, and, in not a few cases, a curiously Hebrew cast of features. The frizzled hair is worn in long pipe-like ringlets, smeared sometimes with red ochre, sometimes left in its natural black color; the use of wigs is not infrequent. The cartilage of the nose is bored, and occasionally something is worn in it. Their ears are generally pierced all round with small holes, in which pieces of grass are stuck; and in many the lobe is torn, and hangs down to the shoulder. On the body and limbs the hair grows in small tufts, so that the skin has a slightly woolly appearance. They go entirely naked, except so far as some slight covering is afforded by the orna-

ments they wear; these are made of mother-of-pearl shells, either circular or crescent-shaped, suspended round their necks. Occasionally, also, part of a large shell, apparently a helmet-shell, is cut into the

A GROUP OF NATIVES OF NEW GUINEA.

shape of a shield, and worn in front of the groin, a very good protection, although we would call it a singular kind of garment.

The dress of the women consists of one or two nessoors, or petticoats, round the waist, and reaching nearly to the knees. These are

composed of the inside part of the large leaves of a bulbous-rooted plant, called "teggaer," of which each strip measures an inch in breadth. The nessoor of the young girls is made of much narrower strips, from the inside of the leaf of the "cabbow" or plantain. They are sown on to a girdle. The younger women are often gracefully formed, with agreeable expressions of countenance, though not what Europeans would consider handsome features. They quickly degenerate, however, as is the case with women in all savage races; the degeneracy arising from insufficient food, and hard labor. The girls wear their hair rather long, but the women cut their tresses short, with a bushy ridge over the top. Some of the elder females shave their heads quite smoothly; and they never wear a wig, or dress their hair in long ringlets, like the men. This gives them a bold appearance.

HORRIBLE PRACTICES AMONG THE FIJIANS.

The Fijians are, or were till very lately, a most savage and degraded race. It is only quite recently that the practice of cannibalism in all its most horrid forms has been given up by them; indeed, in some of the islands it is still practiced, but the natives are now, generally speaking, ashamed of ever having allowed it. When, by King Thakombau, the islands were taken under the protection of Queen Victoria, he sent her as a present a club he valued greatly, with which he had in former days killed no less than three hundred persons, whom he had afterwards eaten. This club, which was made of some very dark wood, he sent to Sydney to be decorated before it went to England. It was beautifully ornamented with silver fern-leaves, and was exhibited in a shop window for some time as a work of art. Another dreadful custom besides the cannibalism is not yet entirely given up by the Fijians: that of burying each other alive, for all sorts of trifling reasons; generally speaking, however, with the consent of the party to be buried. In one of the small islands an old man insisted on being buried alive, because he said that one of his sons had not saluted him in the morning with the usual reverence, which showed that he was getting too old, and losing respect, and he would rather be buried out of the way.

There is a well-authenticated account of a young man who chose to be buried alive because he was growing thin, and was afraid the girls would laugh at him. His father and other members of the family assisted in the ceremony quite cheerfully. This story is told by a sailor of the name of John Jackson, who lived among the Fijians for two years, being detained by force. He learned their language, and they were on the whole good-natured to him, though he often had to escape from one tribe to another when he had happened to offend those he was among. Once he very narrowly escaped with his life.

The Fijians have a great variety of gods, most of whom they seem to consider very like themselves in their tastes and habits. One is supposed to be very fond of turtles, one of human brains. At Nateva, where Jackson lived for some time, there was a temple where the people used to lay various offerings for the use of their gods, roast pigs and muskets among them. On one occasion there was a grand roasting of and feasting on pigs, but Jackson did not consider that he had had his share. Being very hungry in the night, he came to the conclusion that it was much better that he should have a good supper than that the pork should be wasted on his friends' false gods, so he stole into the temple, where he knew the pigs lay, and made a meal off a portion of a small one. When he had finished, he remembered that he had not cut the pig in the same way as the Fijians, and that he would be sure to be found out, so he threw the remainder of the animal into the bush for the dogs to eat. The natives were all extremely puzzled when they found a whole pig had disappeared, but at length they came to the conclusion that one of their favorite gods had swallowed the pig whole. An old priest informed them that Kalau leka (short god) had condescended to appear to him in the night in a state of high good-humor, and had informed him of various favorable events, and thus it was quite evident that his amiability was caused by his having swallowed the whole pig, as when he was hungry he was always unpleasant. The people were all quite satisfied with this story, and boasted so much of the cleverness of their short god in swallowing a pig whole that Jackson was sorely tempted to undeceive them. He refrained, however, for some time, for fear of evil consequences, but at length, when he had become more intimate and friendly with the people, he thought he might venture to tell them the story, thinking it would shake their faith in their ridiculous gods. At first they would not believe him, but when he pointed out the spot where he had thrown the pig, and its bones were found there, they were furious, and he had to run and swim for his life, escaping as best he could from the offended savages.

WEIRD DANCES AMONG THE FIJIANS.

After supper there is always a grand native dance to amuse the king, in front of the palace, an immense fire being lighted, so that the performance may be seen distinctly. These native dances are most strange and wild affairs. The dancers form a circle, and utter a loud shout; they then begin to dance, quietly enough at first, but gradually quicken their movements, each man trying to outdo his companions in the strangeness and grotesqueness of his attitudes, twisting his body, arms, and legs about in apparently the wildest manner, but however excited they become the performers always act in concert, and the dance is as

regularly carried out as a Highland reel. Sometimes they career round and round the fire, crouching on the ground one moment, and then starting up brandishing a spear or club the next, and shouting a sort of wild song all the time.

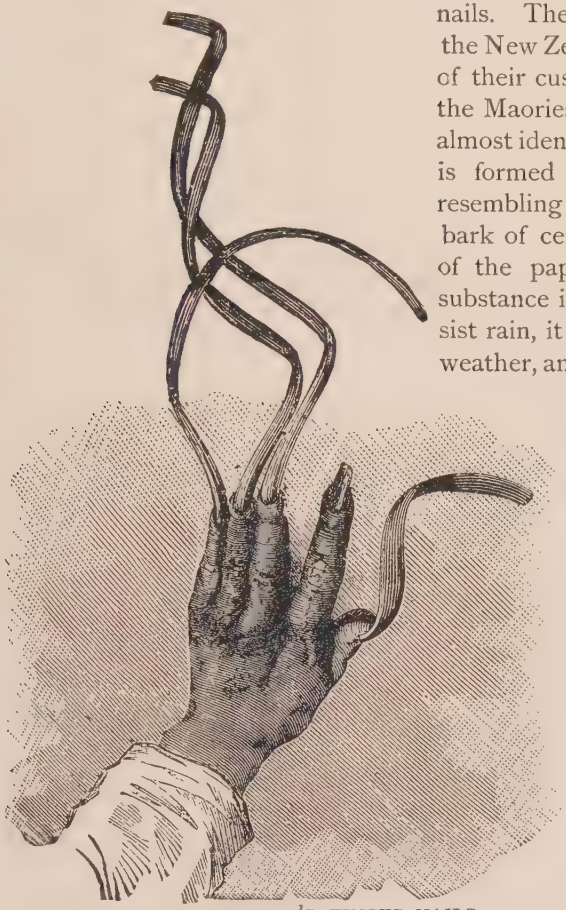
Sometimes girls and women perform dances most gracefully, for they have beautiful figures, and are wonderfully light and agile in their movements. They wear short dresses, made from the bark of trees and dyed all sorts of colors, and shell necklaces, and on their hair, which is always frizzed out into as big a mop as possible, a wreath of flowers. The elaborate way in which the Fijians arrange their hair is supposed to have been the cause of the strange sort of pillow in use among them. This is simply a straight piece of wood, with two little feet to raise it. It is made either of bamboo or hard wood, and is of course miserably uncomfortable to a stranger at first, but some people get accustomed to it, and find it much better than no pillow at all.

PRIDE OF THE NATIVES IN GIVING MONEY.

There is a curious account of a visit to a village on a grand Christian native festival-day, the occasion of the collection of native contributions to the Missionary Society. The little town was full of visitors, every one dressed in his best. The dancing-green, in front of the chief's house, was cleared, and a white flag hoisted in the middle. About eighty young men danced the club dance and the fan dance. They wore fringes hanging round their waists, generally a combination of red and yellow Pandanus leaf (a sort of pine) cut in strips, and black, fibrous girdles of fungus. All their bodies were smeared with cocoa-nut oil. After the first dance, a missionary arrived with three native teachers. A table was set out under a tree opposite the chief's house, and they stood behind it to receive the money. Each man and woman marched up in turn, and threw their money on it, with as loud a rattle as possible. Only silver coins were brought, and the people preferred bringing two sixpences instead of a shilling, because they would make more jingle. They were evidently delighted and proud to make their offerings, and about five hundred dollars were collected. After the collection another party danced; this time the men and boys were painted in all sorts of ways, with three colors, red, white and blue. Some had one-half of the face red, and the other half blue; some had the face red, and body black. Some were spotted with red and blue; some had black spectacles round the eyes, and so on. They wore turbans, and plumes of red feathers in their hair, which waved and shook as they danced; and round their necks pearl oyster-shells set in whales' teeth.

The natives of Tahiti are tall and well made; the color of their skin is not very dark, and their hair, though generally black, is sometimes

red or flaxen: it is always frizzed. They have large mouths, flat noses, and very white, even teeth. The women keep their skin beautifully soft by constant use of the cocoa-nut oil. They wear their hair short. The chiefs are distinguished, like the Chinese mandarins, by very long nails. They are all tattooed like the New Zealanders; indeed, many of their customs are like those of the Maories, and their language is almost identical. The native dress is formed of a kind of cloth, resembling paper, made from the bark of certain trees, particularly of the paper-mulberry. As this substance is not well suited to resist rain, it is thrown aside in wet weather, and a sort of matting used instead. The form of the dress is two pieces, one wrapped round the waist; the other with a hole in the middle, for the head to go through, hangs from the shoulders. Sometimes the dresses are highly ornamented. Both men and women are fond of wearing flowers in their hair.



A TAHITIAN CHIEF'S FINGER-NAILS.

On the occasion of one of the visits of an English ship to Tahiti, the queen came on board, most elegantly attired. She wore a light, loose, flowing dress of white native cloth, tastefully fastened on the left shoulder, and reaching to the ankle. On her head was a pretty bonnet, made of green and yellow cocoa-nut leaves; each ear was pierced in several places, in which fragrant flowers from the Cape Jessamine were fastened. The old priest, who was very attentive to her wore a glazed hat, and a black coat, fringed round the edges with red feathers, and appeared to be proud of his finery.

The food of the common people is almost entirely vegetable. It consists of the bread-fruit, bananas, yams, apples, and a sort of sour

fruit, used to flavor the roasted bread-fruit. The most general dish is "popoi," made of the coarse mountain plantain, beaten up to a paste with cocoa-nut milk. No less than thirteen different kinds of bananas grow in the island. The only quadrupeds (as in New Zealand) are dogs, pigs and rats. As the dogs are fed entirely on vegetable food, they are said to be very good to eat—something like lamb.

There are plenty of birds, wild ducks, green turtle-doves, large pigeons, small parrots, kingfishers, cuckoos, and herons. In the forests are many kinds of sweet-voiced singing birds. There are no snakes, but among the fish with which the sea-coast abounds, a poisonous kind of sea-snake is sometimes found, whose bite is said to be mortal. The climate of the island, which is deliciously warm, and at the same time quite healthy, makes houses almost unnecessary, and the natives build little helters, in very light and airy fashion. They are merely a sort of shed, like the roof of a barn, supported by three rows of pillars. The thatch is palm-leaves, and the floor is strewn with hay, and covered with mats. Under these the natives generally sleep, but they eat and pass the day in the open air. They go to bed about an hour after dark, and use a kind of oily nut, stuck upon a piece of wood, for a candle. The mats in their houses are woven in a wonderfully clever and dexterous manner, of rushes, grass and the bark of trees. They also make very nice baskets, and ropes, and lines, from the bark of a tree, and thread from the fibre of the cocoa-nut. Fishing-lines are made from a kind of nettle, nets of a coarse sort of grass, and hooks from mother-of-pearl. Their tools are stone hatchets, a chisel, generally made from the bone of a man's arm, and a rasp made of coral, or the skin of a poisonous fish, called a sting-ray. All these articles of native manufacture are, however, becoming rare in these days, as they have been entirely superseded by European introductions, for which the Tahitians show the greatest eagerness. Indeed, it does not appear that their warm reception of missionaries arose from any desire for religious instruction. They very soon began to complain that the missionaries gave them plenty of talk and prayer, but very few knives, axes, scissors or cloth. However, these were soon after amply supplied.

A traveler gives a delightful account of his arrival in Tahiti, and of the state of things he found there. He describes the enchanting beauty of the island as he entered the Matavai Bay, with its broken, stupendous mountains, and rocky precipices, clothed with every variety of verdure, from the moss of the jutting promontories on the shore, to the deep and rich foliage of the bread-fruit tree, the oriental luxuriance of the tropical pandanus, or the waving plumes of the lofty and graceful cocoa-nut grove. The scene was enlivened by the waterfall on the mountain's

side, the cataract that chafed along its rocky bed in the recesses of the ravine, or the stream that slowly wound its way through the cultivated and fertile valleys, fringing the banks with the most delicate verdure.

NEARLY CRAZED AT THE SIGHT OF A HORSE.

The natives soon came on board to welcome him, including the king, who was delighted with some cattle which he had brought from Australia, and especially with a horse which was given him, the first that had ever been seen in Tahiti, and whose appearance caused the utmost excitement. The poor animal, which had been hung in slings and unable to lie down during the chief part of the voyage, was hoisted out of the hold to be taken on shore in a large pair of canoes, which the king had ordered for the purpose. While the horse was suspended during the transition, some of the bandages gave way, and he slipped through the slings and fell into the sea! He instantly rose to the surface, and swam, snorting, towards the shore. As soon as the natives saw this, they plunged into the water and followed him like a shoal of porpoises, seizing his mane and tail, and nearly drowning the poor animal in spite of the king's shouts to leave him alone. However, he managed to gain the beach, and as he rose out of the water, the natives on the shore fled in the utmost fright, climbing the trees, and crouching behind the rocks and bushes for safety. The next morning, crowds assembled to see the captain of the ship mount the horse, with which sight the natives were delighted. They called the horse "a man-carrying pig," unable to give it any more appropriate name.

THE RENOWNED SANDWICH ISLANDS.

The Sandwich Islands are the only important group in the North Pacific Ocean. They are completely isolated, being two thousand three hundred and fifty miles from San Francisco, the nearest part of the American coast, and about the same distance from the coast of Japan, from the Marquesas and the Samo Islands to the south, and from the Aleutian Islands a little west of north. They are only connected with the other Pacific islands by bare coral reefs, the nearest of which is about seven hundred miles off. This very central position in mid-ocean, where they are, as it were, a stepping-stone between two worlds, gives the Sandwich Islands much political and commercial importance, and as a place of rest and refreshment for the large fleet of whalers in the Northern Pacific, they are of great value. But besides their advantages of situation, these Sandwich Islands are in themselves most attractive. All travelers agree in their descriptions of their delights. All the beauties and enjoyments of the summer island-world seem concentrated in them, without its frequent drawbacks. The group consists of seven large islands, all inhabited, and four rocky islets. Hawaii, the

largest of the group, is seventy miles across. Hilo, the principal town in Hawaii, is one of the most delightful places in the world. This crescent-shaped bay, said to be the most beautiful in the Pacific, is fringed with cocoa-nut and palm trees, and the town beyond looks from the sea like one mass of greenery, for the white houses are half-buried in the rich, luxuriant vegetation. It is said that if a shower falls anywhere in the Pacific Ocean it may be traced to Hilo; and these continual rainfalls keep the grass, and the trees, and the creepers dazzlingly green, and fill the streams which come leaping down the rocks in endless cascades, while the rich soil, and the heat, and the sunshine combine to make the whole place a garden. Over all tower the two great volcanic mountains, Mauna Kea and Mauna Loa, crowned with almost perpetual snow, which a traveler describes in this way: "Mauna Kea from Hilo has a shapely aspect, for its top is broken into peaks, said to be the craters of extinct volcanoes; but my eyes seek the dome like curve of Mauna Loa with far deeper interest, for it is as yet an unfinished mountain. It has a huge crater on its summit eight hundred feet in depth, and a pit of unresting fire on its side; it throbs, rumbles, and palpitates; it has sent forth floods of fire over all this part of Hawaii, and at any moment it may be crowned with a lovely light, showing that its tremendous forces are again in activity."

In olden times the Hawaiians believed that in this terrible abode dwelt their great goddess "Pélé," who sported with her attendant demons among the sulphurous waves. There is a curious deposit found in the crevices of the vast lava-hill below the crater, which is still called "Pélé's hair." It is of a yellowish-brown color, like coarse spun glass. During an eruption, when the fire-fountains play to a great height, and the lava is thrown about in all directions, the wind catches it and blows it out in long thin threads, which stick to projecting points, and thus this curious-looking substance is formed.

AN ISLAND THAT SHAKES.

There have been many terrible earthquakes in Hawaii, some of which are remembered by the present inhabitants. In 1868 a series of earthquakes began in the month of March, becoming more frequent and startling from day to day, till, as one lady aptly expressed it, the island quivered like the lid of a boiling pot nearly all the time between the heavier shocks. The trembling was like that of a ship struck by a heavy wave. This state of things lasted for a week, and then came the climax on a lovely April day. The crust of the earth rose and sank like the sea in a storm; rocks were rent, mountains fell, buildings and their contents were shattered, trees swayed like reeds, animals were scared, and ran about demented; men thought that the Judgment had

come. The earth opened in thousands of places, the roads in Hilo cracked open, horses and their riders and people afoot were thrown violently to the ground; it seemed as if the rocky ribs of the moun-

THE GRAND MAUNA LOA IN ACTION.

tains and the granite walls and pillars of the earth were breaking up. At Kilauea the shocks were as frequent as the ticking of a watch. In Kau, south of Hilo, there were three hundred shocks in one day An avalanche of red earth burst from the mountain-side, throwing rocks

high into the air, swallowing up houses, trees, men and animals; and traveling three miles in as many minutes, burying a hamlet with thirty-one inhabitants and five hundred cattle. The people of the valleys fled to the mountains, which themselves were splitting in all directions; and collecting on an elevated spot, with the earth reeling under them, they spent the night in prayer and singing. Looking towards the shore, they saw it sink, and at the same moment a wave, whose height was estimated at from forty to sixty feet, hurled itself upon the coast and receded five times, destroying whole villages, and even strong stone houses with a touch, engulfing forever forty-six people who had lingered too near the shore. After this awful day, the earthquakes still continued, and people putting their ears to the ground fancied they could hear the imprisoned lava sea rushing below. At length, after traveling under ground for twenty miles, it burst forth with tremendous force and fury. Four huge fountains boiled up, throwing crimson lava, and rocks weighing many tons, to a height of one thousand feet. A gentleman, who was near the spot at the time, described the scene in these words: "From these great fountains to the sea flowed a rapid stream of red lava, rolling, rushing, and tumbling, like a swollen river, bearing along in its current large rocks, that made the lava foam as it dashed down the precipice, and through the valley into the sea, surging and roaring throughout its length like a cataract, with a power and force perfectly indescribable. It was nothing less than a river of fire, eight hundred feet wide, and twenty deep, with a speed varying from ten to twenty-five mile an hour." These descriptions are terrible enough. Considering the awful nature of the volcanic eruptions and earthquakes in Hawaii, however, the destruction of human life does not seem to have been so great as one would have feared would be the case. There were many marvelous escapes from impending death.

DEATH OF THE CELEBRATED CAPTAIN COOK.

It was at Hawaii that our great navigator, Captain Cook, met with his death—a circumstance as much deplored by the Sandwich Islanders of the present day as by his own countrymen. To Captain Cook is accorded the honor of having discovered these islands, but there are native traditions of much earlier white visitors, and there is no doubt that Spanish navigators landed there in the sixteenth century. However, our first authentic information about them was brought by Captain Cook, who, with his two ships, the "Resolution" and "Discovery," approached the two most westerly of the islands in January, 1778. Great was the amazement of the first natives who went to examine the ships at what they saw. In those days English seamen used to wear cocked hats; these the Sandwich Islanders thought were a part of their

heads, and they described the visitors as having heads "horned like the moon." They stated, moreover, that they had fires burning at their mouths—no doubt meaning cigars—and that they took anything they wanted out of their bodies: such was the idea conveyed by the civilized institution of pockets. All these circumstances, combined with the strange language of the new-comers and the firing of some guns, made the natives come to the conclusion that their visitors were certainly gods. There was a belief in the islands at that time that a certain much-honored god called "Lono" had sailed away in a fit of jealousy and a triangular canoe, having first prophesied that he would return in after times on an island bearing cocoa-nut trees, swine and dogs Captain Cook's ships, so much larger than their own canoes, and with tall masts, now appeared to the natives like floating islands with trees on them, and they made sure that "Lono" was returning to his own country. When Captain Cook landed, they came to the conclusion that he must be the great god himself. They prostrated themselves before him, and brought everything they could collect in the way of food as offerings. Captain Cook does not seem to have discouraged the idea that he was a god. He felt that it insured the safety of himself and his crew, and for a fortnight the ships remained at the islands, all living in clover. Then they sailed away.

Early the following year they returned, and Captain Cook landed, confident of another welcome, on the western side of Hawaii. Here, his fame having spread from island to island, he was again received with divine honors, all the offerings the natives were accustomed to make to their gods being brought to him. The king visited him, and threw over him his own cloak, and presented him with pigs and fruit, concluding the interview by changing names with him—a ceremony which was considered the greatest possible sign of friendship and respect. For a time all went well, as before, but gradually doubts of the divine origin of the visitors began to rise in the native mind. One of them died and was buried: this showed him to be only mortal, like themselves. They began to grudge the supplies for the ships which they had to produce. A quarrel arose between the natives and the seamen, and some of the latter were pelted with stones. Soon after this the ships set sail; they were becalmed within sight of land for a day, and the king sent on board a parting present of pigs and vegetables. All might now have been well, but unhappily the ships encountered a heavy gale, and put back a week later into the Bay of Kealakeakua for repairs, and this time the welcome received by the Englishmen was not nearly as warm as before. Soon some thefts were committed by natives visiting the ships, who could no longer resist stealing pieces of iron, for

which the Pacific islanders in those days craved far more than for gold. Then some shots were fired from the "Discovery" at a canoe. This quarrel was nominally made up, but soon after one of the "Discovery's" cutters moored to a buoy was stolen by a chief. Captain Cook was determined that this boat should be restored, and, trusting to the veneration in which he was held, he went on shore, with the intention of bringing the king back with him, and keeping him as a hostage till the stolen property, so valuable to him, should be given back. The king, it appears, would have consented to this plan, and walked to the shore with Captain Cook; but the islanders would not submit to what they considered not only a great indignity but a great risk. They surrounded the king, and protested against his going on board the ships. His wife, too, entreated him to stay.

While the king hesitated, there came a cry that the foreigners had fired at a canoe and killed a chief. Then the natives began to arm themselves with clubs, stones and spears. The king sat down, and Captain Cook walked towards his boat. As he walked, a native attacked him with a spear, and Captain Cook turned and shot him with his double-barreled gun. Stones were then thrown, and the sailors in the boats, seeing this, fired on the people. Captain Cook tried to stop this, but the noise was so great that he could not make himself understood: and meanwhile a chief approached from behind and stabbed him in the back. Captain Cook fell into the water, and never spoke again. This is the English account of the death of the great navigator, as handed down from Captain King, his companion. The native account differs little from it, except in stating that the warrior-chief who attacked Captain Cook had no intention of killing him, still believing him to be the god "Lono" and immortal, but that, being struck, he gave a cry or groan, which dispelled the belief in his divinity, and the chief therefore killed him. The remains of Captain Cook were subsequently restored to his friends, and he was buried at sea—with what sad and awe-stricken feelings one can well imagine—and the exploring ships sailed away from the bay without the guiding spirit which had brought them there. The work of the great navigator was done, and he lay at rest in the bosom of the mighty ocean whose mysteries he had so long loved to unravel. The fame of his adventures has filled the world.

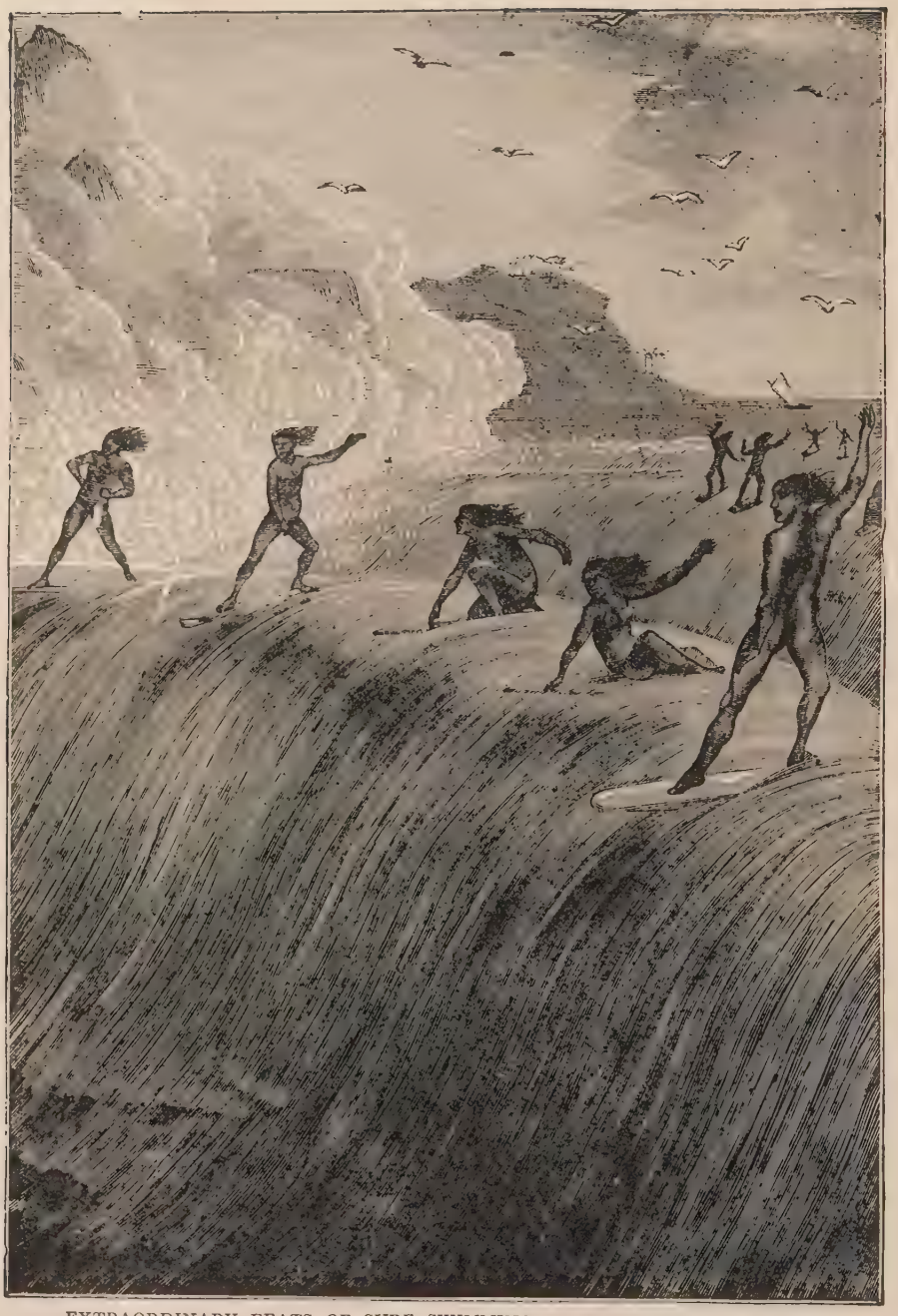
For nearly a hundred years after Captain Cook's death the spot where he fell was only marked by a cocoa-nut stump set up on a bed of stones and broken lava, on which different visitors fixed sheets of copper with simple inscriptions recording the event. Within the last few years, however, a more suitable monument has been erected by some of his fellow-countrymen.

Chief among the amusements of the islanders is the sport of surf-swimming. This is practiced in several of the islands of Polynesia, but in none is it carried out to such perfection as in the Sandwich group. The following spirited account of this sport is given in Captain Cook's Voyages:—Swimming is not only a necessary art, in which both the men and women are more expert than any people we had hitherto seen, but a favorite diversion amongst them. One particular mode in which they sometimes amused themselves with this exercise in Karakakooa Bay, appeared to us most perilous and extraordinary, and well deserving a distinct relation. The surf, which breaks on the coast round the bay, extends to the distance of about one hundred and fifty yards from the shore, within which space the surges of the sea, accumulating from the shallowness of the water, are dashed against the beach with prodigious violence. Whenever from stormy weather, or any extraordinary swell at sea, the impetuosity of the surf is increased to its utmost height, they choose that time for this most exhilarating amusement.

A MARVELOUS MODE OF SWIMMING.

Twenty or thirty of the natives, taking each a long, narrow board, rounded at the ends, set out together from the shore. The first wave they meet they plunge under, and suffering it to roll over them, rise again beyond it, and make the best of their way by swimming out into the sea. The second wave is encountered in the same manner with the first; the great difficulty consisting in seizing the proper moment of diving under it, which, if missed, the person is caught by the surf, and driven back again with great violence; and all his dexterity is then required to prevent himself from being dashed against the rocks. As soon as they have gained, by these repeated efforts, the smooth water beyond the surf, they lay themselves at length on their board, and prepare for their return. As the surf consists of a number of waves, of which every third is remarked to be always much larger than the others, and to flow higher on the shore, the rest breaking in the intermediate space, their first object is to place themselves on the summit of the largest surge, by which they are driven along with amazing rapidity toward the shore.

If by mistake they should place themselves on one of the smaller waves, which breaks up before they reach the land, or should not be able to keep their plank in a proper direction on the top of the swell, they are left exposed to the fury of the next, and, to avoid it, are obliged again to dive and regain the place from which they set out. Those who succeed in their object of reaching the shore have still the greatest danger to encounter. The coast being guarded by a chain of rocks, with here and there a small opening between them, they are obliged to



EXTRAORDINARY FEATS OF SURF SWIMMING BY SANDWICH ISLANDERS.

steer their board through one of these, or, in case of failure, to quit it before they reach the rocks, and plunging under the wave, make the best of their way back again. This is reckoned very disgraceful, and is also attended with the loss of the board, which I have often seen, with great terror, dashed to pieces at the very moment the islander quitted it. The boldness and address with which we saw them perform these difficult and dangerous manœuvres was altogether astonishing, and is scarcely to be credited.

These swimmers used often to pass nearly a mile seaward, in order to enjoy the rapid motion of their return as long as possible. Both sexes and all ranks unite in it, and even the very chiefs themselves, who have attained to the corpulency which they so much admire, join in the game of surf-swimming with the meanest of their subjects. Some of the performers attain to a wonderful degree of skill, and not content with lying on the board, sit, kneel, and even stand on it as they are hurled shoreward by the giant waves. The boards are of various sizes, according to the age and stature of the owner. For adults they are about six feet in length. They are slightly convex on both sides, and are kept very smooth—all surf-swimmers cherishing a pride in the condition of their boards, and taking care to keep them well polished and continually rubbed with cocoa-nut oil.

A ROCK-BOUND ISLAND.

Pitcairn's Island, which is only about six miles long and three broad, looks like a mere speck in the vast Pacific Ocean. It is completely iron-bound with rocky shores, and landing there in boats is always difficult, though it is safe to approach within a short distance in a ship. The water is extraordinarily deep close to its very shores, and it is impossible for ships to anchor there. But within the rocky precipices round the coast are lovely valleys with palm forests, and groves of cocoa-nut trees, and bread-fruit, and the climate is delicious and the soil rich. It is one of the Edens of the Pacific Ocean.

The idols of these people are very rough, clumsy things, and though they believe them to have great power, they do not always treat them with much respect. The Typees, one of the tribes, had a baby god, of whom they thought a great deal, called Moa Atua; it looked like a bit of a broken war club with a rough human head carved at one end, and was swathed round in scarlet and white tapa, and carried in the arms of the chief priest. This is the curious ceremony they go through. The priest caresses and dandles Moa Atua, and whispers in its ear; when it makes no answer he appears to get provoked, and bawls to it; no answer being vouchsafed still, he gets apparently very angry indeed, strips the baby god of its finery, and buries it in a hole. By-and-bye

he takes it out again, whispers once more, and then informs the bystanders of various interesting communications which it has made to him, and which they firmly believe. It is believed that if Moa Atua were so minded, he could cause a cocoa-nut to sprout out of his head, and that it would be the easiest thing in the world for him to take the whole island in his mouth, and dive to the bottom of the sea with it.

FINE SPORT IN THE WATER.

All the natives of the Marquesas Islands are splendid swimmers, and pass a great deal of their time in the water, splashing and diving about. Among the Typees canoes were tabooed to women, so if they wanted to get from one place to another, they were forced to swim. The mothers put their babies into the water soon after they are born, and let go of them for a minute or two at a time, and by being launched in this manner, like little ducks, they soon swim of their own accord. Of course, the water is very nice and warm in this part of the world, so that it is only like being put into a large warm bath, which babies always like, and not at all the same thing as being plunged into the cold rough sea. They may be said to grow up in the water.

Easter Island is a very remote and rather dreary little island, some thirty or forty miles round. It is so named, because it lies eastward of all the islands of the South Pacific Ocean. Pitcairn is its nearest neighbor of any consequence. It has a stony and hilly surface, and an iron-bound shore. At the south of the island there is an extinct volcano, and the hills seem to be chiefly formed of lava. There is no safe anchorage at Easter Island, no wood for fuel, no fresh water, and no domestic animals, except a few fowls. The inhabitants live on yams, potatoes, and sugar-cane, the soil being so exceedingly fertile that three days' work is sufficient to provide sustenance for a native for a whole year. No wonder that the inhabitants of these regions are inclined to be idle, and take things as easily as possible.

The early missionaries and settlers tell us that often when they tried to get the natives to build more comfortable houses and adopt different modes of civilized life, they would answer: We should like some of these things very well, but we cannot have them without working; that we do not like, and therefore would rather do without them. The bananas and the plantains ripen on the trees, and the pigs fatten on the fruits that are strewed beneath them, even while we sleep; these are all we want, why therefore should we work?

STRANGE SIGHTS ON EASTER ISLAND.

The natives of Easter Island are fair Polynesians, resembling those of Tahiti and the Marquesas, but they are said to be occasionally cannibals. They make long low houses, something like a canoe

turned upside down, with a small opening at the side which serves for door and window; but there are much better and more interesting houses than these in the island built of stone, about which the present inhabitants know nothing. Easter Island is celebrated for the wonderful remains of some prehistoric people, who must have lived there ages before the race who now inhabit it, and about whom the people there now cannot tell us anything at all. The remains consist of these stone houses, sculptured stones, and gigantic stone images. The houses are built in regular lines, with doors facing the sea, the walls are five feet thick and nearly six feet high, they are built of layers of irregularly-shaped flat stone, and lined inside with upright flat slabs. These are painted with figures of birds and animals, chiefly fabulous creatures (for quadrupeds are little known in Easter Island), and geometrical figures. Quantities of a particular kind of shell were found inside the houses, and in one of them a statue eight feet high was discovered, which is now in the British Museum; it weighs four tons. Near these houses the rocks on the brink of the sea cliffs are carved into all sorts of strange shapes, sometimes like odd human faces, and sometimes like turtles. There are hundreds of these carvings, often overgrown with bushes and grass of a very course rank kind which grows over the island. But the most extraordinary of these ancient remains are found on nearly every headland round the coast, where there is almost always an enormous platform of stone, more or less in ruins. Towards the sea there are high walls built of immense stones most ingeniously fitting into one another without cement, and within stone platforms and terraces have been leveled with large slabs which have been pedestals for the images, now thrown down in all directions and

WONDERFUL MONUMENTS ON EASTER ISLAND.

more or less broken to pieces. One of the most perfect of these platforms had fifteen images on it. Most of these statues were fifteen or eighteen feet high, and some thirty-seven feet. The figures are human bodies without legs, the heads being flat to allow of crowns being put on: these crowns were made of a red material found only at a crater about three miles from the stone houses. At this place there still remain numbers of these crowns, some of them ten feet round, waiting to be removed to the heads for which they were intended. How it was that they were never placed on these heads, what brought this strange work suddenly to an end, or who were the people engaged in it, we do not know, and shall probably never find out. A certain stone implement, a long pebble with a chisel edge, is believed to have been the chief tool used in making these wonderful statues, but it is almost impossible to believe that with this alone such gigantic works could have been executed in such numbers and in such a small island, isolated from the rest of the world.

The difficulty is so great that some writers believe that there may have been once a civilization over the Pacific Ocean of which neither we nor the inhabitants we found there have ever heard or know anything. Possibly Easter Island may have been a sacred spot to all the islands round, and different tribes may have combined together to erect these wonderful images there, and may have worshiped them as their gods. But nothing is known for certain, and Easter Island remains the greatest mystery of the Pacific Ocean, a wonder unexplained.

MARVELS OF COPPER-COLORED BEAUTY.

The group of islands called the "Marquesas" was named in honor of a Spanish marquis, who discovered them in 1595. The islands are very numerous, and vary in size from ten to twenty miles. They are not encircled or protected by coral reefs, though there is plenty of coral to be seen on the beach; the coast is very rocky and abrupt, but there are many good harbors, such as Resolution Bay in Tahuata, which is a particularly fine and safe one. All the usual fruits and plants of the South Seas grow there, and the climate is warm, but very healthy. The inhabitants belong to the same race as those of the Society and Sandwich Islands. They have dark copper-colored skins; but that of the women is much paler than of the men. They are said to have wonderfully beautiful figures; and one navigator describes a chief the measurements of whose body agreed exactly with those of the Apollo Belvedere. The tattooing with which he was adorned must have entirely destroyed the resemblance to the Apollo. This art is carried to a greater degree of perfection in the Marquesas Islands than in any other nation. The bodies of distinguished persons are completely covered with regular

figures in most tasteful and elaborate patterns; and this process makes their skin darker than it would be otherwise. The women, who are nearly as fair as Caucasians, and very beautiful, do not often disfigure themselves in this way, being content with their natural adornment.

The island of Java has been styled, on account of its natural beauty and fertility, "the Queen of the Eastern Archipelago." It forms a leading link in the great chain of islands extending from the Bay of Bengal to the shores of New Guinea. In this crescent Java occupies the middle place. It is bounded north by the Java Sea, and south by the Indian Ocean. It measures six hundred and thirty miles in length, and varies from thirty-five to one hundred and twenty-six miles in breadth. Its total area is nearly two-thirds of the area of the New England States.

A TATTOOED CHIEF OF THE MARQUESAS ISLANDS.

On the south by the Indian Ocean, the coast is steep and rocky, and forms a sufficient rampart against the incessant roll of the billows; but on the opposite side, where only a shallow channel separates it from Borneo, the land terminates in a low, flat, alluvial plain, bordered by extensive mangrove swamps. The coast-line is irregular and broken, especially on the north.

Throughout its entire length Java is traversed by two chains of mountains, which occasionally unite, but more frequently run at some distance

from one another, and send spurs and branches of the most various outline down to the shore. These chains are lofty and imposing; grand in outline, and surrounded by mighty forests. Occasionally their towering peaks soar to an elevation of twelve thousand feet; they seldom descend below seven thousand; and the average height of the volcanoes with which each chain is thickly studded, may be taken at nine thousand feet. Many of the volcanoes are still active; so that along the axis of the island a series of fire-towers seem to be planted, like burning beacons, to throw their warning light far over the Indian seas. This volcanic character of the mountains, while accounting for the fertility of the island, also explains the peculiar aspect of its scenery. They have nothing of that austere, that almost terrible grandeur which distinguishes the heights of the Alps and Rocky Mountains. They are remarkable for beauty rather than sublimity. Volcanic cones are so regular in their shapes, and stand out so definitely as objects of perfect form and symmetrical outline, that they give an almost architectural tone to the scenery. One traveler compares them to noble columns or pyramids which are perfectly beautiful, in the recesses of which the imagination loves to wander, and at times to lose itself. The volcanic peaks of Java, moreover, are clothed even to their topmost ridges with wood and green waving grass, except one or two summit cones of cinders and ashes fresh from the crater; but these, too, from the effect of distance, look as smooth as if built up of sand, and are regular in shape.

A MAGNIFICENT LANDSCAPE.

Mr. Jukes enables us to realize the general features of a Javanese landscape from one of his descriptions. He sketches the picture which unfolds before the spectator from the north-west corner of the broad green, undulating valley-plain of Malang. On the right hand, towards the west, rises the picturesque group of the Kawi, from which a verdurous but broken and serrated ridge strikes northward to the grand mountain-mass of the Ardjoonoo, immediately in our rear, with its peaked summit and shaggy sides, occupying all the north-western quarter of the horizon. A low gap in the north has been seized upon by man, and cultivated, while a road running through it opens up access to the northern coast and its towns and harbors. Towards the east, with many a bristling peak and ridge, towers the massive Tengger range, reaching its greatest elevation in the large crags and buttresses of the Bromo and the Ider-Ider. Thence it curves towards the south-east, to crown itself with the shapely and symmetrical cone of the Semiru, and present a scene of great natural sublimity.

The chord of this magnificent amphitheatre, or the distance between Semiru and the Kawki, is nearly forty miles, and is formed by low un

dulating ridges which close the prospect on the south. The aspect of this great valley is joyous and exultant with luxuriant beauty; everywhere it is fresh, and fertile, and radiant; bright in tint and varied in

A REMARKABLE VOLCANIC CRATER, ISLAND OF JAVA.

outline; while even the wildest and ruggedest of the mountains are profusely clothed with virgin forests, except the two cones of the Semiru and Ardjoonoo, where still reigns the demon of the volcanic fires

Java has been appropriately called the Land of Fire. It possesses upwards of forty volcanic mountains, which, taken together, display all the phenomena of igneous action, except lava-streams, which never occur in Java. The active craters are remarkable for the quantity of sulphur and sulphurous vapors which they discharge. The crater of Taschem contains a lake, about a quarter of a mile in length, from which issues a stream so strongly impregnated with sulphuric acid, that no forms of life can exist in it, and even fish cannot live in the sea near its mouth. Near Butar, an extinct volcano, about half a mile in circuit, is known as the "Vale of Poison." No living creature can enter it with safety; and it is said that the soil is strewn with the carcasses of birds, deer, and other animals, killed by the fatal carbonic acid gas which accumulates in the hollow of the deadly valley.

Owing to its mountainous character, Java has no great navigable rivers; but it is watered by many shallow streams, which carry brightness and fertility along with them in their rapid course. These may be ascended to some distance in the light proas and canoes of the natives; but only a few are open to vessels of any considerable burden.

Much of the charm of the Javanese landscape lies in the extraordinary richness of its vegetation, which clothes every valley-side and every mountain-height with masses of diversified foliage. This richness is not to be wondered at, when we remember that the soil consists of decomposed volcanic rock, limestone and sandstone; that it is abundantly watered, either by nature or by art; and that the climate exhibits a remarkable range of temperature. At an elevation of six thousand feet the thermometer does not rise above sixty degrees; in the plains, during the day, it ascends from eighty-five degrees to ninety-four degrees, and during the night from seventy-three degrees to eighty degrees. The character of the natural products of the island is necessarily affected by this variation of temperature; and the traveler, beginning with the flora of the Tropics in the plains and warm moist valleys, ends with that of the Temperate Zone on the breezy mountain-heights. The coast, which in some places is fringed with coral reefs, is generally lined with feathery groves of cocoa-nut trees. Inland spread vast fields of rice, extending up the sides of the hills, and irrigated by a multitude of artificial water-courses. They yield two and three crops a year. Hedges and terraces rise to a considerable height, which, as they wind round the flanks of the hills, produce all the effect of stately amphitheatres. Hundreds of square miles of country are thus terraced, and convey a striking idea of the industry of the people and the antiquity of their civilization. These platforms are annually extended as the population increases, the inhabitants of each village working in concert under the

direction of their chiefs; and it is by this system of village culture alone that such immense areas of terraces and irrigating canals have been rendered possible.

The wonderful mountain vegetation almost surpasses any adequate description. The colossal wild fig-trees are among the most grateful presents of Nature to hot countries; the shade of their magnificent head refreshing the traveler when he reposes under their wonderfully wide-spreading branches and dark, green, shining foliage.

The most remarkable species is the banyan. In its early state the banyan resembles other trees in having a single trunk of variable size,

A TREE WHOSE BRANCHES TURN TO ROOTS.

and a dense head of foliage. The branches spread out horizontally to so great an extent that they would be unable to support themselves simply by their attachment to the parent stem. To supply the necessary support the branches throw out here and there small fibrous shoots towards the ground. On reaching the ground they take root, gradually increase in size, and become stable supports for the parent bough, and even rival the original trunk itself. A fresh start is taken from these secondary stems, and the lateral branches continue to throw out new shoots until the plant attains an extent which is almost incredible, and alone forms in time a considerable forest. The height of the tree is at the same time slowly increasing. Single trees have been seen which

were fully five hundred yards in circumference round the extremities of the branches, and about one hundred feet high. The principal trunks were twenty-five feet to the first branches, and had a diameter of eight or nine feet. They are largest about the villages which are situated in fertile valleys among the mountains. They daily afford shelter to man and cattle, to pilgrims and travelers, who at times congregate in great numbers beneath their branches. The public meetings and merry-makings of the villagers are held under their grateful shade.

The leaves of the banyan are of an elliptical cordate shape, about six inches long. They are used by the natives as plates for their meat. The wood is light, white and porous. The fruit, which grows on the smaller twigs, has no stem; when ripe it has the size and color of a middle-sized red cherry. It is eaten by monkeys, paroquets and other birds, but is insipid, and therefore seldom made use of by natives, and never by white men, as an article of food. The seeds are said to grow the better after having been picked by birds. Birds scatter them in the most curious places, sometimes in the angles between the leaves and stem of the Palmyra palm, where they grow, sending down their stem, so as to embrace entirely the palm, except its crown of feathery leaves, and giving the palm the appearance of growing out of the trunk of the banyan. Such a combination forms an object of religious veneration to the Hindoos, who call it a holy marriage instituted by Providence.

The banyan is generally supposed to be the only fig whose branches send down supporting stems into the earth. Recently another species has been found in one of the islands of the New Hebrides Group which has the same habit. Its leaves are very small, scarcely an inch long. One tree, described by its discoverer, was one hundred feet high, forty-five feet around the trunk, and its branches covered a space two hundred and sixty feet in diameter. The natives had built their houses under its shade.

The bases of the mountains, whither we must now carry our survey, are clothed with vast forests of different species of the fig-tree tribe; some of which seem allied to the Indian banyan; all are interlaced and bound together by creepers and trailing parasites, and are remarkable for their immense height, so that their overarching foliage glimmers like a green mist, their milky sap, their fruit, and their far-spreading branches. At about the same height above the sea grow noble trees of different families, their boughs embellished with fantastic orchids, and their trunks covered with parasites, while among the low undergrowth rise grand arborescent ferns of surpassing beauty. Here we meet with the screw-pine, in stature and character resembling the palms. Higher up we come to the plane-like liquid-ambars, their tall and shapely stems clasped

round by fences of fruit-trees here and there, inclosing the Javanese villages, in which the huts are built of bamboo, and with their high-pitched roofs and quaint construction seem to have been modeled after the well-known architectural designs of the willow-plate. The white buildings and tall chimney of a sugar-mill occasionally diversify the prospect; the open fields are skirted by rows of bamboos; and the straight and well-kept roads run through monotonous avenues of dusty tamarind-trees. At each mile, in a queer little wooden guard-house, a policeman is stationed, who communicates with his comrades by means of a gong; and the din of that discordant instrument frequently alarms the echoes of the quiet country. If we penetrate further inland, we come upon the remains of deserted cities, now given over to the wild bull and the tiger; or in the recesses of the forest we pause before some colossal statue of a god, or one of the ancient temples, such as that of Borobodo. Here a central dome, fifty feet in diameter, and surrounded by a triple circle of seventy-two towers, covers, with its terraced walls, the entire slope of the hill. Such magnificent specimens of human industry and science are seldom found in so small a compass!

THE WILD OX OF JAVA.

We may now take a rapid glance at the animal life of Java. If domestic and marine animals be included, it boasts of no fewer than one hundred species of mammals. In the west of the island the one-horned rhinoceros stalks among the ruined temples; and in the high wooded districts and dense jungles of the upper valleys may be found the tiger-cat, the panther, and, more formidable than either, the royal tiger, annually demanding its human victims. Neither the tapir nor the elephant is an inhabitant of Java. Among the Suidæ may be named the wild hog and the babyroussa; the latter a fierce and dangerous animal, with four strong tusks projecting above the snout. The napu, or Java musk, is one of the most graceful of the moschine deer. The

wild ox is numerous in the woods, and remarkable not less for the beauty of his shape than the untamableness of his disposition. Of the Ape family the only representatives are the silvery gibbon, and the ubiquitous "tailed ape;" these are found in almost innumerable hosts, and the forests resound with their noisy chatterings.

Two kinds of lemurs belong to Java, and are regarded by the natives with all the dread that arises from superstitious ignorance. Probably their alarm is increased by the animal's nocturnal habits. For it is at night that the loris awakes from its slumbers: night, when the birds on which it preys are resting in unsuspicious tranquility, with their heads screened by their soft plumage. Then through the forest-gloom its large round eyes burn like two balls of red-hot iron; and by these eyes alone can its presence be detected, for, owing to the color of its fur, its outline is invisible, and its white breast may be mistaken for a slanting moonbeam falling athwart a branch. With slow and stealthy movements it glides along the trees—lifting paw after paw, and advancing step by step, until it has gained its victim's resting-place. The destroyer raises its hand, until the long, curved fingers overhang and nearly touch the sleeping bird, which in a moment is torn from its perch and slain, almost before it has opened its startled eyes.

To Java also belongs the largest member of the Bat tribe, measuring five feet across its membranous wings. It abounds in the neighborhood of the orchards and gardens; hanging suspended from the branches during the day, and then at night banqueting freely upon stolen fruit. Java is dowered with volcanic fires. Notwithstanding its limited area, it possesses as many as the entire American continent, and all of them more terrible than burning Etna. And to these we must add its liquid volcano, its vein of sombre azure, which the Javanese call the "Black River." This is the great Equatorial Current, which, in its northerly course, warms the Asiatic seas; is remarkable for its muddiness; and tastes salter than human blood.

A hot sea—a torrid sun—volcanic fire—volcanic life! Not a day passes but a tempest breaks out among the Blue Mountains, with lightning so vivid that the eyes cannot endure to gaze at it. Torrents of electric rain intoxicate earth and madden vegetation. The very forests, smoking with wreathed vapors in the burning sun, seem so many additional volcanoes situated midway on the mountain slopes. In the loftier regions they are frequently inaccessible, and sometimes so thickly intertangled, so dense, so gloomy, that the traveler who penetrates them must carry torches even at noonday. Nature, without an eye to watch her, celebrates there her "orgies of vegetation," and creates her river-monsters and colossi.

CHAPTER IV.

WONDERS OF ASTRONOMY.

Our Sun one of the Stars Composing the Milky Way—Astronomy of the Ancients very Crude—Fable, History, and the Animal Kingdom Furnish Names for the Constellations—Vulcan's Shield—Stars of Different Magnitudes—Constellations of Great Brilliancy—The Great Bear—Glowing Tribute of an American Poet—Little Bear—Pole-Star—The Pivot of the Sky—Cassiopeia—Andromeda—The Northern Crown—Stars Blue, Yellow, and Red—An Old Legend—Hair Transformed into a Constellation—Hunting Dogs—The Zodiac—The Ram—The Bull—Famous Pleiades—The Twins—Cancer—The Lion—Scorpion—He-Goat—Aquarius—The Fishes—Old-time Fancies—Renowned Orion—Longfellow's Beautiful Description.

OUR world is placed in the midst of a vast nebula; its equatorial stratum, projecting itself on our sky, describes that cloudy zone known under the name of the Milky Way. Our sun is one of the stars composing this gigantic cluster, and all the stars which sparkle during our silent nights form part, like him, of this same tribe. This is, properly speaking, our universe. The other nebulæ may be considered by us as other universes, foreign to this one, and which we have only contemplated in order to give us a more distinct notion of the grandeur of creation, but which we will henceforth leave in the unexplored immensity which they inhabit in the midst of space.

The astronomy of the ancients, says Francœur, the renowned scientist, was confined to a few rough distinctions; they were at first contented to name the planets and most beautiful stars, and we have preserved this custom; but when they wished to study more carefully, and wished to describe stars of less brilliancy, they could only follow a method, the imperfection of which they acknowledged. They were led like the naturalists who, to name the species of the three kingdoms, unite under a common name a certain number of creatures, which they afterwards distinguish from each other by a qualification.

Astronomers have united the stars in different groups, on which they have drawn an animal or fabulous being. To these groups, or constellations, they gave names from fables, history, or the animal kingdom. These denominations, consecrated by antiquity, are quite arbi-

trary; and unless imagination itself creates images, as it sees pictures in the ever-changing contours of the clouds, we must not endeavor to find in the groups of stars anything which might recall the figure or imitate the image of the objects whose name the constellation bears. The necessity of being guided on the seas obliged man to choose in the heavens invariable signs by which he could direct his course, and this is the historical origin of the constellations.

CYCLONE OR SPIRAL NEBULA.

The ancients formed representative maps of the heavens, and from the time of Hipparchus, the Greek astronomer, they were able to class the stars, distinguishing them according to their brightness, in the positions occupied by each of them on these figures.

It was necessary to fix on a method to find a particular star easily, in the midst of such a great number (four to five thousand) as is distinguished with the naked eye. The first origin of the constellations is unknown; but it is imagined that they were established successively. The Centaur Chiron, Jason's preceptor, has the reputation of having first divided the heavens on the sphere of the Argonauts; but Job lived before the time, when the precedent is placed, and we are told he spoke of Orion, the

Pleiades, and Hyades, three thousand three hundred years ago. Homer also speaks of these constellations when describing Vulcan's shield:

> And on its surface many a rare design
> Of curious art his practised skill had wrought,
> Thereon were figured earth, and sky, and sea,
> The ever-circling sun, and full-orbed moon,
> And all the signs that crown the vault of heaven;
> Pleiads and Hyads, and Orion's might,
> And Arctos, called the Wain, who wheels on high
> His circling course, and on Orion waits;
> Sole star that never bathes in th' ocean wave.

The same mythological divisions are used in the present day. Since the establishment of Christianity, there have been many efforts to reform this pagan system, and to replace it by Christian denominations. In the planisphere of Bede, St. Peter is substituted for the Ram, St. Andrew for the Bull, etc. From these attempts, no name escapes; David's chariot, Solomon's seal, the three Magi kings, or Jacob's rod, etc., date the highest. Later still a German proposed to give to the twelve signs of the Zodiac the heraldry of the twelve most illustrious houses of Europe. These singular efforts remained sterile, and the mythological reign has continued until the present day.

As great diversity has been noticed in the brightness of stars, they have been classed in order of magnitude. This word "magnitude" is improper, seeing that it has no relation to the dimensions of the stars, these dimensions being still unknown to us; it dates from a period when it was believed that the brightest stars were the largest, and this is the origin of the denomination; but it is important to know that this is not its real sense. It simply corresponds to the apparent brightness of the stars. Thus, stars of the first magnitude are those which shine with the greatest brightness in dark nights; those of the second magnitude shine less, and so on. Now, this apparent brightness belongs both to the real size of the star, its intrinsic light, and its distance from the earth; consequently, it only possesses an essentially relative meaning. Nevertheless, it may be said generally that the brightest stars are nearest, that those whose pale glimmer is scarcely distinguished in the field of the telescope are more distant.

Thus, when we speak of the magnitude of stars, it is to be understood that we refer simply to their apparent brightness; this brightness greatly facilitates the means of distinguishing them among the constellations. There is now another fact which is not less important to consider as relative, and not as absolute; this is the arrangement of the stars or forms of the constellations. We know, already, that the sky

is not a concave sphere in which bright nails are fastened, and that there is no kind of vault—only immense, infinite void surrounding the earth on all parts and in every direction. We know, also, that the stars, suns in space, are scattered at every distance in the vast immensity. When, then, we notice two stars close together in the sky, their apparent proximity does not in any way prove their real proximity; they may be very distant from each other, in the direction of vision, at a distance equal to or greater than that which separates us from the nearest one.

APPARENT POSITIONS OF THE STARS.

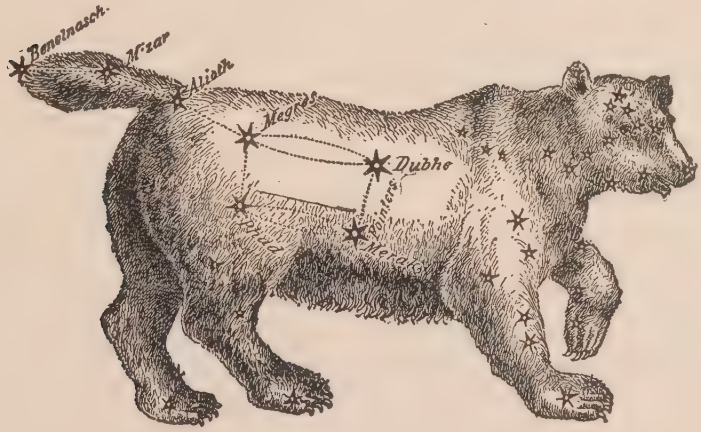
In a similar way, when four, or five, or more stars are united in the same group, this does not imply that these stars, forming the same constellation, are on the same plane and at an equal distance from the earth. By no means. Dispersed at all depths of space, all around the terrestrial atom, the arrangement which they display to our eyes is only an appearance caused by the position of the earth with regard to them. This is purely a matter of perspective. When we find ourselves during the night in the midst of a large, open space in which numerous gaslights are dispersed, it is difficult for us to distinguish, at a certain distance, the most remote lights from those which are less so: they all appear to be projected on the dark ground; moreover, their general arrangement depends purely on our point of view, and varies according as we ourselves walk away or across. This simple comparison may make us understand why the stars, lights in the dark space, do not reveal to us the distances which may really separate them, and why their arrangement on the apparent vault of the sky depends only on the spot where we place ourselves to examine them. On quitting the earth's surface and transporting ourselves to a spot sufficiently distant, we should witness, in the apparent arrangement of the stars, a variation as much greater as our station of observation would be more distant from our previous one. For this it would be necessary to transport ourselves, not only to the last planets of our system, but beyond this system entirely, and to go to distances at least equal to those of the nearest stars. Indeed, from Neptune, the last planet of our system, the stars are seen in the same arrangement as from here. The change is only seen in quitting one star for another. One moment's reflection suffices to convince us of this fact, and to relieve us from further explanation on the subject.

MAGNIFICENT CONSTELLATIONS.

These illusions once appreciated at their right value, we may, without fear, begin the description of the figures with which old fables have constellated the spheres. The knowledge of the constellation is neces-

sary for the observation of the heavens and for researches which love of science or curiosity may inspire; without it, we are in an unknown country, without any geography or possibility of discovering our whereabouts. Let us, then, form the geography of the heavens. The innumerable figures of animals, men, or objects, with which the sphere is adorned, will not all be drawn here, seeing that they would only serve to confuse the mind with imaginary lines. Formerly they printed celestial atlases, where the figures were represented with exquisite care, so much so, indeed, that they ended by forgetting the stars, and the sky was nothing more than a menagerie. In spite of the interest of the images, we will not follow this example. At present, let us see how to direct our course for reading correctly the great book of the heavens

There is one constellation known to everyone; for greater simplicity



URSA MAJOR, OR GREAT BEAR.

we will begin with it, as it will serve as a starting-point to go towards the others, and as a sign to find its companions. This constellation is the Great Bear, which has also been called David's Chariot, or Charles's Wain; which the ancients called *Septem triones* (whence came the word *septentrion*), or, again, *Helix*, *Plaustrum;* which the Greeks addressed under the name of *Arktos Megale;* which the Arabs called *Aldebb al Akbar*, and the Chinese, three thousand years ago, addressed as the *Tcheou-pey*, the god of the north. Thus it can boast of a high celebrity. If, however, in spite of its universal notoriety, some have not yet had occasion to make its acquaintance, the following is the sign by which it may always be recognized. Turn towards the north, that is to say, opposite the spot where the sun is at noon. Whatever may be the season of the year, the day of the month, or hour of the

night, you will always see there a large constellation formed of seven stars, four of which are quadrilateral, and at an angle with the side.

Have you not all seen it? It never sets. Night and day it watches above the northern horizon, turning slowly in four-and-twenty hours around a star of which we shall speak presently. In the figure of the Great Bear, the three stars of the extremity form the tail, and the quadrilateral forms the body. In the Chariot the four stars form the wheels, and the three the car. Above the second between these latter, good sights distinguish a very small star called Alcor, which is also called the Cavalier. The Arabs used it to test a good eye.

A GLOWING DESCRIPTION.

This brilliant septentrional constellation, composed of stars of the second magnitude, has received from olden times the gift of captivating the attention of observers, and personating the stars of the north. Many poets have sung its praises; we will only repeat in prose one—the words being worthy of the majesty of the heavens—that of Ware, our American poet: "With what grand and majestic steps this northern constellation advances in its eternal circle, following its royal path amidst the stars with a slow and silent light! Mighty creation, I worship thee! I love to see thee wandering in the brilliant avenues like a splendid giant with a strong belt—severe, indefatigable, and resolute, whose feet never pause on their road. Other kingdoms abandon their nocturnal path and rest their wearied orbs under the waves; but thou, thou never closest thy fiery eye, and never stoppest thy determined step. Forward, always forward! while systems change, suns set, worlds sleep and awaken, thou followest thy endless way. The adjacent horizon endeavors to arrest thee, but in vain. A vigilant sentinel, thou never quittest thy secular path, but, without allowing thyself to be overtaken by sleep, thou preservest the fixed lights of the universe, always preventing the north from forgetting its place.

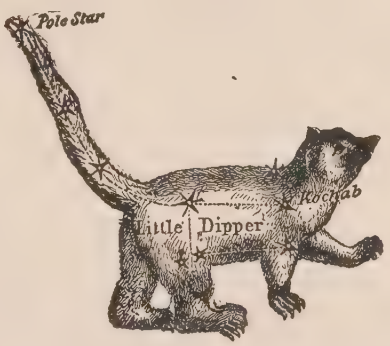
"Seven stars people this bright kingdom; the sight embraces the whole; their respective distances are not inferior to their distance from the earth. And here again we see the tremendous distance between the celestial orbs. From the depths of the heavens, unexplored by the mind, the piercing rays dart through space, revealing to the senses numberless systems and worlds. Earth, sun, and nearest constellations, what are you amidst this infinite immensity and the multitude of divine infinite works?"

These thoughts, inspired by scientific truth, are superior to those of ancient mythology.

The Great and Little Bear were considered as Callisto and her dog. Jupiter had a son whose mother was a nymph, the cow-herd (Boötes);

he had them both placed in the sky. But the official wife of the king of gods, Madame Juno, as Virgil has said, was greatly incensed, and obtained from Thetis, the ruler of the waves, a decree that these perfidious constellations should never bathe in the ocean. Thus their continued presence above the horizon is explained. Callisto, whose car fears the wave of Thetis, near the ice of the north shines out near her son. The Dragon embraces them like an immense wave. According to others, the two Bears are nymphs who fed Jupiter on Mount Ida; according to others, again, they represented the oxen of Icarus.

If a straight line be carried through the two stars, a star less brilliant than the preceding ones is found, which forms the extremity of a figure like the Great Bear, but smaller and directed in a contrary direction. This is the Little Bear, or Little Chariot, also formed of seven stars. The star to which our line brings us, that which is at the extremity of the Bear's tail, or at the end of the shaft of the Chariot, is the Pole-Star. Always found in its place, it is an example of fidelity.



URSA MINOR.

The Pole-Star has a certain renown, like all personages who distinguish themselves from others, because, among all the stars which twinkle in our starry nights, it remains immovable in the heavens. At any moment of the year, day or night, if you observe the sky you will always find it occupying the same place. All the other stars, on the contrary, revolve round it every twenty-four hours, a hold for the centre of this immense whirlpool! The Pole-Star remains immovable over one pole of the world, whence it is used as a fixed point by navigators of the pathless ocean, as well as by travelers in an unexplored desert.

CASSIOPEIA.

Looking at the Pole-Star, stationary in the midst of the northern region, we have the south behind us, the east to the right, the west to the left. All the stars revolving round the Pole-Star, from right to left, ought to be recognized according to their mutual relations rather than according to the cardinal points. On the other side of the Pole-Star, relating to the Great Bear, is another constellation easily recognized. This is Cassiopeia, which is formed of five stars of the third magnitude, arranged somewhat like the slanting strokes of the letter M. This group takes every possible position, going round the pole; sometimes

being above, sometimes below, sometimes to the left and sometimes to the right; but it is always easy to find, seeing that, like the preceding constellation, it never sets and is always opposite to the Great Bear. The Pole-Star is the axle around which these two constellations revolve.

A FAMOUS ANCIENT LEGEND.

The stars bordering on the pole, and which have therefore received the name of Circumpolar Stars, are distributed into several groups. And here we have one of the greatest dramas of ancient mythology. To repeat this famous episode in a few words, we will mention that Cassiopeia, wife of Cepheus, king of Ethiopia, one day had the vanity to believe herself more beautiful than the Nereides, in spite of the African color of her complexion. These sensitive nymphs, piqued to the quick by such pretensions, prayed Neptune to avenge them of such a gigantic affront; the god allowed fearful ravages to be made by a sea-monster on the coasts of Syria. To stay the plague, Cepheus chained his daughter, Andromeda, to a rock and offered her in sacrifice to the terrible monster. But young Perseus, touched with so much misfortune, quickly bestrode the horse Pegasus, a model of coursers, took in his hand the Medusa's head, which froze the beholder with fright, and started for the fatal rock. He arrived naturally just at the moment when the monster was going to devour his prey, and nothing was more easily done than to petrify the monster by presenting Medusa's head to him, and to liberate the fainting Andromeda. This is a scenic effect from which painting has derived advantage in every sense; there are perhaps as many Andromedas as Ledas, and these are innumerable. It must be owned also that the painter has not often so captivating a subject. The combat of Perseus with the monster is without equal in history.

CASSIOPEIA.

THE ZODIAC.

The Ram is the first sign of the zodiac, because, at the time when this principal part of the celestial sphere was established, the sun entered this sign at the spring equinox. In the fable, it represents the Ram with the golden fleece of the Argonaut expedition, because at the moment when the sun rises in this sign, guarded by a monster (the

Whale) and by a Bull which vomits flames, the constellation Ophiuchus or Jason, comes out in the evening at the same point, and thus subjugates the vanished Ram. The Ram was also the symbol of spring and the opening of the year. These two causes were indicated by the translator of Plutarch. The Bull comes afterwards. We go from west to east. We shall easily recognize it by the group of the Pleiades which sparkle on its shoulder, by that of the Hyades which glimmer on its forehead, and by the magnificent star which marks its right eye, the star Aldebaran, of the first magnitude. It is, moreover, situated just above the splendid constellation of Orion.

The Pleiades, which are seen in the annexed engraving, are a group of about 80 stars, resolved by the telescope. The ancients counted in the Pleiades seven stars more brilliant than the ground sprinkled with golden dust. At the present time only six can be counted with the naked eye. Alcyone in Pleiades appears to be the central point of the universal heavens.

TAURUS.

This region, marked with Orion, Sirius, the Twins, the Goat, Aldebaran and the Pleiades, is the most magnificent region of the celestial sphere. It is towards the end of Autumn that it shines in our hemisphere in the evening. The Twins are, in the fable, Castor and Pollux, sons of Jupiter, celebrated for their indissoluble friendship, for which they were rewarded by immortality. The Greeks also gave the name of Castor and Pollux to those lights which appear round vessels after storms, electrical phenomena now called the fires of Saint Elmo.

The Crab or Cancer may be distinguished at the bottom of the line of Castor and Pollux, in five stars of the fourth or fifth magnitude. It is the least important body of the zodiac. While Hercules was fighting the Lion of Nemea, the Crab, aiding the vengeance of Juno, pinched the heel of the hero, who crushed it with his foot, but the queen of heaven gave it its reward by placing it in the heavens.

THE LION OF THE SKY.

The Lion is a cluster of beautiful stars, situated to the east of the wins. The most brilliant of these stars is of the first magnitude, and is called Regulus, the heart of the Lion; the three others are of the second magnitude. The sun enters the Lion at the summer solstice, and causes it to disappear by covering it with his fires; this is the victory of Hercules over the Lion of Nemea. It was also for the same cause the symbol of strength and power. Being the abode of the sun during the month of July, it was again the sign of burning heats and of plagues which they sometimes brought with them. In the eyes of astrologers of the middle ages, this was its terrible aspect. The Virgin comes after the Lion.

Emblem of justice and law, the Virgin represents Themis, with the scales at her feet. Why has she wings? Perhaps because Justice, formerly on the earth, abandoned it for heaven. She is also Astrea, daughter of Jupiter and Themis, men's crimes having forced her to return to heaven at the end of the golden age. She has the privilege of representing a great number of persons; the entire list would be too long, the following being only a few of them: Ceres, symbol of harvests; Diana, of Ephesus; Isis, of Egypt, goddess of Syria; Atergatis, of Fortune; Cybele, drawn by lions; Minerva, mother of Bacchus; Medusa; Erigona, daughter of the Cow-herd; lastly, in the time of Virgil, she was the Sybil, who, with branch in hand, descended to the infernal regions. With so large a choice, she seems to have preferred the title of Daughter of Justice, exiled to the celestial regions by man's crimes.

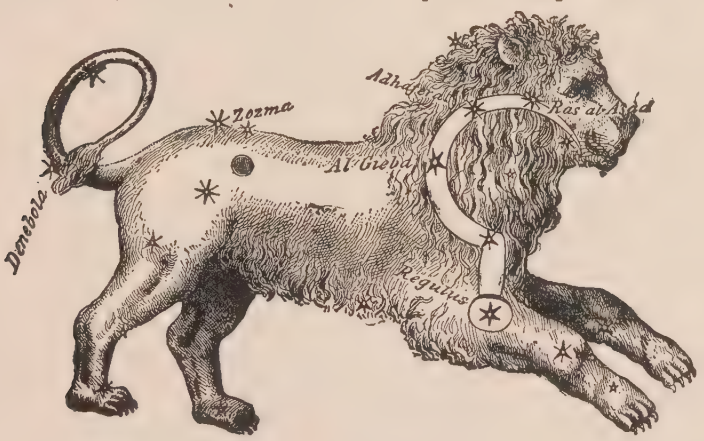
THE TWINS.

The Scorpion, with its heart marked by the brilliant Antares, a star of the first magnitude, is easily recognized. It is not that the form can be distinguished; for this form is not better sketched out by the stars which compose it, than the preceding figures have been. But it is well understood that, when we speak of recognizing a constellation, we refer simply to the groups of stars which bear its name and not to its mythological figure. The Scales and Scorpion only formed one sign, with the Latins before Augustus: the Scales were then the claws of the Scorpion. As Augustus was born on the 23d of September flat-

tery leagued itself with astrology to celebrate the happiness promised to the earth by the birth of this emperor; the Scales, which the Egyptians had formerly instituted in the original sphere, were replaced in the heavens as a symbol of Justice.

The verses of the Eneid may now be easily interpreted. As a sign of misfortune and fear, the Scorpion was cursed among all the constellations. It was said, especially, that it had an invincible hatred towards Orion, because this figure sets when the former rises, and *vice versa*. It was not only the terror of the stars, but also the terror of the sun himself, that Ovid has described it to us.

Copernicus (the He-goat) is not rich in bright stars. Those which sparkle on his forehead, are the only ones which can be distinguished by the naked eye. In some authors Copernicus represents the goat



LEO.

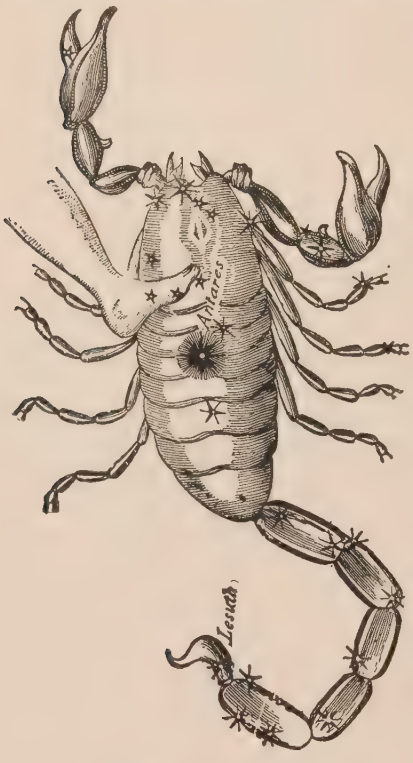
Amalthea, which nursed Jupiter on Mount Ida, and received a place in heaven as a reward. According to others, it represents the return of the sun to the winter solstice through the gates of the tropics. Again, according to others, it was a he-goat which was brought up with the king of the gods, and which discovered and sounded the marine trumpet, and produced fear among the Titans in their war with Olympus. The frightened gods hid themselves in the forms of different animals; Apollo changed into a crane, Mercury into an ibis, Diana into a cat. Such a metamorphose was never seen. Lastly, Pan into Capricornus, having a goat's body and the tail of a fish. He appeared, also, to wish to steal away with the giants who scaled heaven.

A CELESTIAL WATER-FALL.

Aquarius forms with his three tertiary stars a very obtuse triangle. The base is prolonged in a string of stars from the side of Capricornus,

and towards the left to the Urn. Thence begins a sinuous line of very small stars descending to the horizon. This is the water poured out by Aquarius. Aquarius appears to personify Ganymede, who was raised by Jupiter's eagle to serve as cup-bearer to the gods after the downfall of Hebe.

The Fishes, the last sign of the Zodiac, lie to the south of Andromeda and Pegasus. The northern fish is that which wished to devour Andromeda; the western fish advances in the square of Pegasus; they are bound together by a band. Not so apparent as the preceding, this constellation is composed of two rows of very small stars. Ovid tells how Venus and Love, wishing to steal away at the pursuit of the giants, crossed the Euphrates on two fishes which were for this placed in heaven. It is related that two fishes having found an egg of a very beautiful shape, drew it to shore, that a dove sat on it, and Venus came forth. It was from this time that the Syrians abstained from feeding themselves on fish. This sign is the last abode of the sun before the renewing of the year, in the month of February.



THE SCORPION.

We have thus given an explanation of the signs of the Zodiac; the uncertainty which reigns over their origin has allowed many to be suggested. I shall only recount here, that which supposed them to be the twelve labors of Hercules, a suggestion which does not lack a certain ingenuity. Hercules would be no other than the sun himself, considered in his attributes relatively to the different times of the year. Francœur, in his *Uranographie*, according to Lalande and the philosopher Dupuis, charged himself with supporting this curious system.

The entrance of the sun into the solstitial Lion which he made to disappear by covering it with his fires, is the victory over the Lion of Nemea. In proportion as the sun advances he crosses Cancer, the Lion, and the Virgin; the different parts of the Hydra are eclipsed by

turn; first the head, then the body, and lastly the tail; but then the head reappears in its heliacal rising. This is the triumph over the Hydra rising again from the Lake Lerna, which Hercules burned, after having crushed the Crab which aided it. The sun crossing the Scales at the time of the vintages covers the Centaur with his fires. The fable states that the Centaur Chiron, having received Hercules, taught him the art of making wine. It adds that, in a drunken dispute, the people of the Centaurs wished to kill Hercules' host, which caused the hero to fight with them; this appears to relate to the setting of Sagittarius in the evening. Lastly, in hunting, he conquered a monster, called the wild boar of Erymanthus, which was believed to refer to the rising of the Great Bear in the evening.

LEGENDS CONCERNING HERCULES.

Cassiopeia, who is represented also by a hind, in the morning sets in the waves when the sun is in Scorpion, which happens at the autumnal equinox; it is this hind with golden horns which, in spite of its wonderful velocity, Hercules tired out in a race, and caught at the water's edge when she reposed.

At the rising of the sun in Sagittarius, the Eagle, Lyra (or the Vulture), and the Swan situated in the Milky Way, disappear at once; these are the birds of the Lake Stymphalis, driven out of Arcadia by Hercules, whose arrow is placed among them. Capricornus, or the celestial He-goat, is bathed in front by the water of Aquarius; these are the stables of Augias cleansed by a river passing through them.

The sun in Aquarius, or the winter solstice, was near Pegasus; in the evening the Vulture was seen to set, whilst the Bull passed the meridian; it was said that Hercules, on his arrival in Elis, to fight the Bull of Crete and the Vulture of Prometheus, mounted the horse Arion and instituted the Olympic Games, which are celebrated at full moon of the summer solstice; the moon is then exactly in Aquarius, that is to say, in the region opposite to the Lion. The carrying off of the mares of Diomedes, son of Aristes, relates to the rising of Pegasus and the Little Horse, the sun being in the Fishes. These two Horses are placed above Aquarius, which is Aristes.

Hercules afterwards starts for the conquest of the Golden Fleece, Aquarius and Serpentarius rise in the evening, whilst at the same time the Ram, Cassiopeia, Andromeda, the Pleiades, and Pegasus set Hence the victory of Hercules over Hippolyte, queen of the Amazons, whose belt (Mirach) shines with a bright light. Many of these warriors had the names of the Pleiades.

At the rising of the Bull, the cow-herd (Boötes) sets, and the Great

Bear (the oxen of Icarus) rises. This is the defeat of Geryon and the carrying off of his oxen. Hercules kills Busiris, persecutor of the Atlantides: the fable which alludes to Orion pursuing the Hyades, and who is then hidden in the solar beams. The return of Spring is moreover explained by the destruction of the venomous reptiles of Crete and by the defeat of the brigand Cacus; that of the river Achelaüs, changed into a bull, relates to Eridanus, which is situated below.

After having founded Thebes in Egypt, Hercules went to the infernal regions, delivered Theseus and carried off Cerberus. The sun has arrived in the northern hemisphere; the Great Dog, whose heliacal setting took place in the preceding sign, is now absorbed in the sun's brightness; he is taken from the infernal regions, and brought to the light. The river of Aquarius, which rises in the evening with the Swan, when the sun has traversed the constellation of the Twins, is Cycnus conquered at the borders of Penea.

A CURIOUS FABLE.

Returned to the summer solstice, the sun recommences its revolution; this is the apotheosis of Hercules. Fable relates that Dejanira, seeking for a love-potion to keep her husband, sent him a shirt soaked in the blood of the Centaur Nessus. Hercules put it on to sacrifice to the gods, and to ask of them the immortality promised for his exploits; but, devoured by the poison in the garment, the hero burnt himself on the funeral pile. This is the sense of this fable. The sun has entered the Lion and rises, whilst the constellations Hercules and Aquarius are about to set. The Centaur sets a little after the Lion; this one then causes Hercules to die, and Aquarius, Ganymede, is carried off to pour out nectar to the gods, in the place of Hebe, given to the hero. The reconciliation of Hercules and Juno relates to Aquarius, who is dedicated to the goddess.

Hercules lived 52 years, had 52 wives and accorded the Nemean honors to 360 of his companions who died for him; this alludes to the 52 weeks of the year and to the 360 degrees of the Zodiac. The Pillars of Hercules were the western limits of the known earth, where the sun seemed each day to set in the sea.

However vague many of the interpretations just put forth may seem to be, adds Francœur, there are some so remarkable that they cannot be supposed to be altogether the effect of chance; thus Hercules was not a hero whose good actions excited men to erect altars to him; but the sun, considered in his attributes relative to the different epochs of the year; an opinion agreeing with the most revered testimonies of the ancients.

ORION.

Among the southern constellations Orion is the most beautiful; we must not pass it without doing homage to it. It is during fine winter nights that this constellation shines over our heads. No other season is so magnificently constellated as the winter months. Whilst nature deprives us of certain enjoyments on the one hand, it presents us with others no less precious. The wonders of the heavens present themselves to us from the Bull and Orion at the east, as far as the Virgin and Boötes at the west; of eighteen stars of the first magnitude, which may be counted in the whole extent of the firmament, a dozen are visible at nine o'clock in the evening, not counting many beautiful stars of the second order and the remarkable nebulæ and heavenly objects very worthy of the attention of mortals. Thus it is that nature establishes everywhere harmonious compensation and, whilst it darkens our short and frosty winter days, it gives us long nights enriched with the wealthiest creations of the heavens.

ORION.

The constellation of Orion is not only the richest in bright stars, but it conceals also treasures for the initiated which no other can present. We might almost call it the California of the heavens. Let us speak first of its nebula, situated below the second star of the Belt. The first time that Huygens, its discoverer, admired this cosmical beauty, in 1656, he was sufficiently astonished to say, that it seemed an opening in the sky which threw light on a more brilliant region. "Astronomers," he states, "have counted in the sword of Orion three stars very near each other. In 1656, I accidentally observed that in place of one of these stars which occupy the centre of the group, there were a dozen of them, a result which is not rare to obtain with telescopes. Of these stars there were three which, like the first, nearly touched each other, and four others seemed to shine through a cloud in such a manner that the space which surrounded them appeared much more luminous than the rest."

Since that period this nebula has been studied with a kind of predilection; it has been minutely examined and the different regions of its cluster have been studied and described in all their details. In proportion as the instruments have become more powerful, the stars, which constellate it, appear more numerous, which has happened in all telescopic observations of nebulæ; and, whilst in early days it was asked with great uncertainty if there was only a phosphorescent cloud, a vaporous mass—astronomers afterwards arrived at the conviction that it was formed of an immense number of heaped-up suns, and then again that it was a true cosmical cloud. At the centre is seen a brighter part of singular form; Sir John Herschel compared it to the head of a monstrous animal, with gaping mouth, the nose being prolonged like the trunk of an elephant.

It occupies a large space in the sky, its apparent dimension being equal to that of the lunar disk. When we think of the distance which separates us from this agglomeration, we are dismayed at the real extent which it embraces in the midst of the boundless void.

But the strangest phenomena which are attached to this nebula are the changes which are observed in it. The drawings which are now taken differ from those which were taken half a century ago. "The general impression that I have received from these observations," said the director of the Russian Observatory not long ago, "is that the central part of the nebula is in a state of continual agitation, like the surface of the sea."

BOUQUETS OF SUNS.

Orion possesses many other riches. The star of the left foot, Rigel, is one of the most beautiful double stars. This double star is composed of a white and a blue sun.

Two other binary systems are met with in the two stars at the extremities of the belt. The first to the right is composed of a white and a purple sun; the second, of a yellow and a blue sun. Thus here are three systems of the most dissimilar worlds united in the same constellation. In each of these systems two suns instead of one; not only two suns like ours, but two differently colored suns; in the planets which belong to the first, a white and a blue body dispute the empire of the day with each other, giving rise, by the numberless combinations of their heat, light and electrical power, to a variety of actions incomparable and unimaginable by us, who are devoted to one sun. In the planets which belong to the second, it is a purple sun which diversifies the white light of its compeer. In that of the third, the number of colors is essentially different from ours, as there is no white light, the generator of every tint; and presents an unknown series of shades, the

result of the combinations of gold and sapphire. These planets are doubtless green, and the color of the objects on their surface must probably oscillate round this medium either as yellow or blue.

But this wealth of stellar systems does not yet constitute all the patrimony of this beautiful constellation of Orion. It contains, besides, the most complex of multiple systems which have ever been met with in the heavens. In the nebula of which we have just spoken, an extraordinary star is met with, a little below the Sword. This star, divided by the telescope, presents to our admiration six suns collected in one point of the heavens. Four principal stars of the fourth, sixth and seventh magnitudes, are arranged at the four angles of a trapezium; the two stars at the base have each a very feeble companion. That these six stars form in reality a physical system and that they are connected together, like the binary systems, by the law of attraction, is a statement we do not wish to affirm. It may be that this is only an optical effect—that these six stars are in reality completely independent of each other, situated at immense distances and depths, but, being on the line of sight very near together, they appear to us collected on one plane. Nevertheless, there are probabilities in favor of the opinion which considers this sextuple star as an actual system, especially when we see that the movement belonging to the principal star is shared by the five others.

In speaking of Orion, Longfellow, has pictured this occultation in bright colors:

Sirius was rising in the east,
And, slow ascending one by one,
The kindling constellations shone.
Begirt with many a blazing star,
Stood the great giant Algebar,
Orion, hunter of the beast!
His sword hung gleaming by his side,
And, on his arm, the lion's hide
Scattered across the midnight air
The golden radiance of its hair.
The moon was pallid, but not faint,
And beautiful as some fair saint
Serenely moving on her way
In hours of trial and dismay,
As if she heard the voice of God.
Unharmed, with naked feet she trod
Upon the hot and burning stars,
As on the glowing coals and bars
That were to prove her strength, and try
Her holiness and her purity.

Thus moving on with silent pace,
And triumph in her sweet, pale face,

She reached the station of Orion.
Aghast he stood, in strange alarm!
And, suddenly, from his outstretched arm,
Down fell the red skin of the Lion
Into the river at his feet.
His mighty club no longer beat
The forehead of the Bull; but he
Reeled as of yore beside the sea,
When, blinded by Œnopion,
He sought the blacksmith at his forge,
And, climbing up the mountain-gorge,
Fixed his blank eyes upon the sun.

In the fable, Orion, the handsomest man of his time, was of such high stature, that when he walked on the bottom of the sea, his head exceeded the height of the waves; which means that this constellation is half beneath the equator and half above.

To the southeast of Orion, on the line of the Three Kings, shines the most magnificent of all stars, Sirius, of the constellation of the Great Dog. This star of the first magnitude marks the upper eastern angle of a great quadrilateral. The stars of the quadrilateral and the triangle are all of the second magnitude. This constellation rises in the evening, at the end of November, passes the meridian at the end of January, and sets at the end of March.

Sirius being the most brilliant star of the heavens, and astronomers daring to attempt operations relative to the study of the distances of stars, this attracted their attention. After long and minute study they succeeded in determining its distance; 1,375,000 times the distance of the sun. To traverse the distance from the earth to this star light takes nearly twenty-two years. Hence, it follows that, when we see it, it is not the Sirius of to-day which is before our eyes but rather the Sirius of twenty-two years ago. The name we now give to the Great Dog formerly belonged to the whole constellation, and not a single Egyptian monument is found where this figure is indicated without its representing Sirius, a name derived from Osiris, the sun.

CHAPTER V.

WONDERS OF THE ATMOSPHERE.

A Storehouse of the Marvelous—No Such Thing as Cold—Beautiful Vapor Crystals—Gorgeous Pictures of the Sun—The Wonderful Mirage—Striking Effects of Frost—Aerial Navigation—The Great Voyage Across Europe—A World Far Below—The Balloon in Warfare—Despatch from a Balloon to President Lincoln—The Dreadful Cyclone—Theory of the Whirlwind—Trade Winds—Snow and Rain in Colors—A Rain of Ink—Marvelous Showers of Dust and Fishes—Brilliant Sunsets—The Barometer and Thermometer—Men Who Thought They Could Fly.

NOT only is the atmosphere, by which the earth is enveloped, the great source of life to the animal creation, but it is a vast museum and a storehouse of the marvelous. Its phenomena as exhibited in cold and heat, the frost that chills the vapor and the sunbeams that warm the world, and displayed also in the discoveries of balloonists, are of the most interesting and remarkable description. The atmosphere is the medium of light and warmth from the sun. It shows us the falling snow with its crystal shapes, the golden dawn and flaming sunset, the worlds that hang their lamps in the firmament and the beautiful rainbow that flings its gorgeous arch across the sky.

Every one knows that there is no such separate existence as "cold." Cold is only an absence of heat; hence, when we require great cold, we must use some body which is demanding large quantities of heat. The confectioners apply this principle in making ices. The creamy preparation, placed in a metallic vessel, is immersed in broken ice mixed with salt. Now it happens that, for some unknown reason, salt and ice so act upon each other as to force the ice to liquefy, but this it is unable to do unless it has heat: this it abstracts from the cream, which consequently freezes. Two parts of pounded ice mixed with one of common salt can reduce the temperature thirty-six degrees below the freezing-point of water; or if, instead of the salt, three parts of crystallized chloride of lime be used, so low a temperature is produced that mercury will freeze. Yet, low as we can get the temperature by these freezing mixtures, it is nothing to the wonderful degree of intense cold which the vaporization of some liquids can produce.

There is every reason to believe that gases are in reality liquids in vapor. Many of them, by being forced into a wrought iron receiver

by means of a forcing pump, can be liquefied. Of course, when the liquid is taken out of the receiver, and relieved of the enormous pressure under which it existed, it immediately endeavors to go back to its gaseous state. It is in a tremendous hurry to do this, and, seeing it is unable to become a vapor without it receives a large increase of heat, it commands all the surrounding bodies to deliver up their heat in the most peremptory manner. Laughing-gas, or nitrous oxide, so condensed under a pressure of four hundred and fifty pounds on every square inch of the receiver which held the gas, and then liberated, can produce a temperature by its rapid evaporation nearly two hundred degrees below the freezing-point of water; and, by causing this process to go on under the exhausted receiver of an air-pump, the greatest cold has been produced—very nearly three hundred degrees below the temperature of ice.

But perhaps a more remarkable fact is this: that it is possible to cause extremes of temperature to exist in the closest juxtaposition. If some of the liquefied gas above mentioned be placed in a red-hot platinum crucible, and then a little water dropped on it, the water will go into ice. Imagine freezing in a red-hot crucible! nay, even mercury can be made to take the solid state under similar circumstances, and frozen mercury is so cold that when held in the hand it will blister it as though it had been a piece of red-hot iron. The reason that the liquefied gas was not instantly dissipated by the heat is the same as that which causes a drop of water to dance about on an almost red-hot plate of metal: the drop does not really touch the plate, but is surrounded by an atmosphere of vapor, upon a thin layer of which it rests. An ingenious application of this really wonderful fact has been long in use in glass-works. The mode of making plate-glass is to blow a cylinder of glass, then cut it open and spread it out. To make the cylinder even and symmetrical, the glass is blown in a wooden mould, the sides of which are wet with water; the red-hot glass converts this into steam, which keeps the glass from burning the wood, and also from touching the water, which would at once spoil it, rendering it brittle.

If possible, more wonderful, and indeed, all but incredible, is the finding of ice over which a lava-bed has been poured centuries ago. The ice was first covered with a layer of cinders, which are bad conductors of heat; then came the molten lava; and the non-conducting power of the ashes proved sufficient to prevent the heat of the lava from melting the ice. This is an occurrence by no means rare.

The ancient historian Herodotus tells us, in his gossiping way, that the Scythians reported of the country lying beyond them, and further to the north, that it could neither be passed, nor yet discerned with the

eye, on account of the feathers which were continually falling. With these both the earth and the air were so filled as effectually to obstruct the view. He had himself sufficient acquaintance with natural phenomena to conjecture that by feathers the wild inhabitants of Scythia in reality meant snow; but it is more than probable that when the uninformed denizens of warmer latitudes first gazed, in their travels, on the spectacle of a snow-storm, they verily believed, and reported in all honesty, that feathers had been falling to the ground. The nursery story of the "old woman picking her geese" may thus have had its counterpart in the infantile ages of the life of the human race. Snow is always a wonder to him who sees it for the first time, and, familiar as it is to us, we occasionally meet with people to whom it is utterly strange. Youths born in India, for example, gaze upon a snow-fall with astonishment and admiration.

WONDERFUL SNOW CRYSTALS.

But there are wonders in the snow, with which many who look upon its coming as quite a matter of course, may be unacquainted. Such a wonder is presented in the phenomena of crystallization. Snow is produced by the freezing of moist vapors suspended in the atmosphere; and in very low temperatures the flakes or particles of snow are found to assume the most elegant and regular forms. These, from their perfect geometrical proportion, are denominated crystals, that name being applied to all particles of matter which take a definite geometrical shape. Snow crystals are of infinite variety and beauty. Captain Scoresby, the Arctic traveler, who was the first to observe them, gave ninety-six illustrations of their graceful forms, in his description of the Arctic regions.

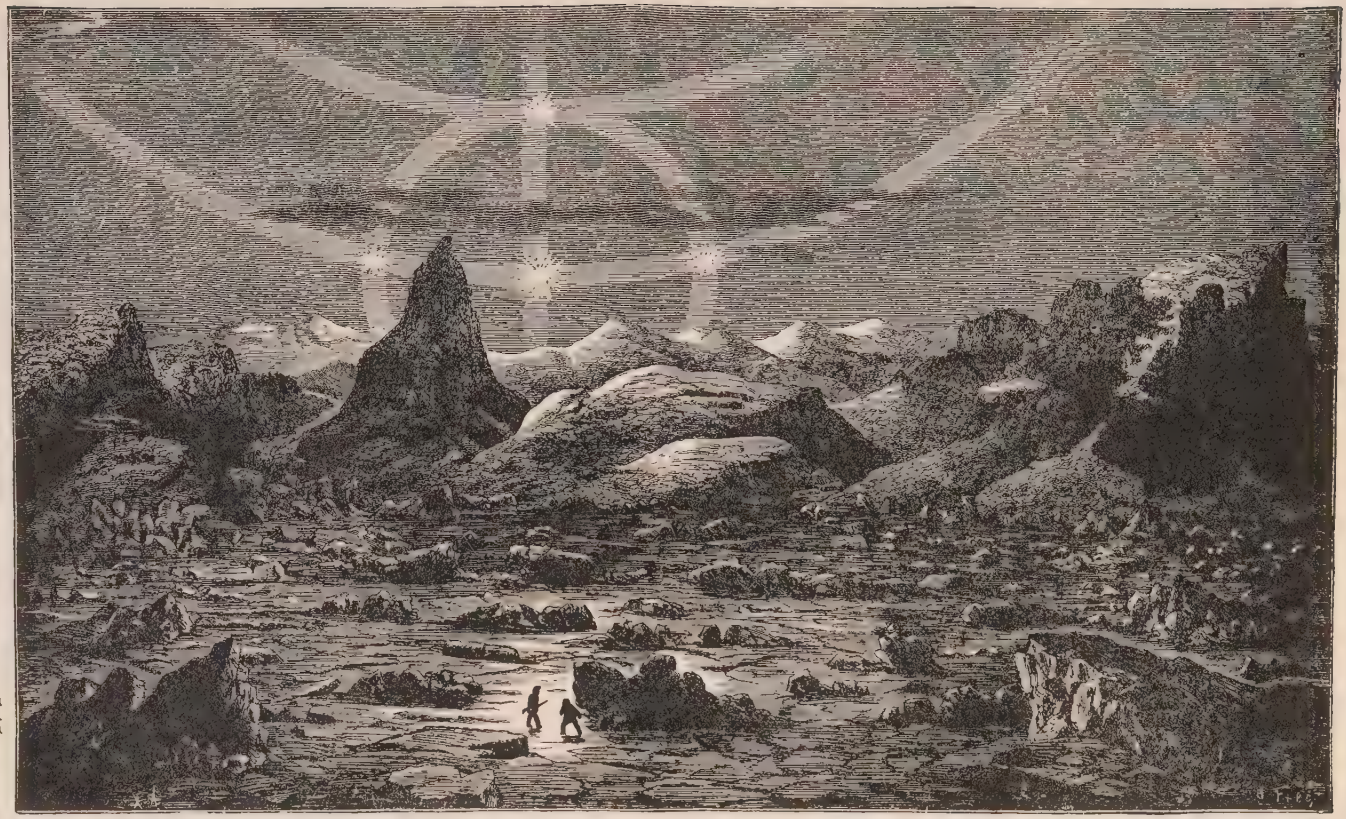
It was at first thought that only such extreme cold as that of the Arctic regions could produce this crystallization. On investigation, however, it was discovered that in our own severe winters the snow presents an equally wonderful appearance; and an eminent meteorologist has given to the world a representation of one hundred and fifty figures from the snow, which had come within his own observation. These were quite as beautiful and diversified in character as those noticed in the Polar seas.

One striking feature in the snow crystals is this: that though differing so widely in character, they are all, or nearly all, hexagonal or six-sided in shape. Occasionally three-sided figures are seen, but these are very rare. Sometimes three of the sides are shorter than the other three, so that the figure is like a triangle with the points cut off; and now and then two small figures are connected together by a slender bar or link. As a rule, however, the hexagons consist of thin plates shaped like beautiful stars, and sometimes surrounded by other stars of similar nature. The great variety of these appearances is apparently inexhaustible, for each investigation has resulted in the discovery of forms previously unobserved, although possessing the general characteristics to which we have alluded. The angle of sixty degrees is also found to prevail in all the various ramifications of these stars amid the snow, in conformity with the law by which water always crystallizes at this angle. Thus there are constellations in the flying snow.

BRILLIANT PICTURES OF THE SUN.

The intensity of the colors of the rainbow has been found to depend in a great measure on the size of the drops of water from which it forms itself. When a rainbow is seen in a fog, the colors of it are always remarkably faint, owing to the minuteness of the drops of water on which the sun's rays fall; so, on the other hand, when we see a rainbow following, as it were, in the wake of a pelting April shower, we are always struck with the vividness and intensity of its hues. The remarkable appearance represented in the illustration is a very peculiar rainbow which was observed by Ulloa and Bouguer during their stay in the Pichincha, and called by them, from the singular faintness of its tints, the white rainbow. It is also known as Ulloa's circle, from the name of one of the travelers who witnessed it.

Ulloa was with his fellow-travelers, one morning at day-break, on the summit of the Pambamarca. The whole of the mountain-top was covered with a dense fog, which gradually dispersed as the sun rose. By degrees the atmosphere became tolerably clear, with the exception of a few light vaporous clouds, so filmy as to be scarcely perceptible. While they were noticing these gradually disappear, one of the travelers, on turning round suddenly to that quarter of the sky which was exactly opposite to the rising sun, perceived an image of himself reflected in the air as distinctly as in a mirror, and standing, apparently, at about the distance of twelve feet from him. The figure appeared to stand in the centre of three concentric rings, which were shaded with different colors, while around the whole was a fourth ring, tinted with one color alone. The outermost edge of each of the three interior rings was crimson, the next color was orange, which shaded



MARVELOUS MOCK SUNS—THE LUMINARY PAINTED ON MIST.

off through yellow into a pale straw, while the innermost tint was green. The figure, with the surrounding rings, followed every movement of the observer, the rings always keeping the figure in their centre. The atmosphere is a storehouse of vivid colors.

Another very singular atmospheric effect is produced by the rays of the sun, and sometimes those of the moon, striking, not upon drops of water, but upon minute crystals of ice. Clouds formed of such crystals are stated by aeronauts to exist in the highest regions of the atmosphere, where they constitute those clouds which are known among meteorologists by the name of cirrus. The most frequent phenomena of this kind seen in temperate climes are what are called halos, such as we so often see round the moon on a slightly misty night. The circular rings of light are divided by luminous diameters. On these lines, a little outside each circle, brilliant patches of light are seen to form, which are called mock suns or mock moons, according as the sun or moon happens to be the centre of light. Those just outside the inner circle are beautifully colored with the different hues of the prism, while those altogether outside are nearly colorless Frequently, also, arcs of circles are seen touching the principal halos, and these, especially at the point of contact, are brilliantly colored. These are most perfect round the inner circle; when they are seen touching the outside one they are usually faint and indistinct.

AMAZING SPECTRAL ILLUSIONS.

The beautiful, deceptive phenomenon known as the mirage is of three distinct kinds. First, there is that form of it where some distant object, below the line of the horizon, and consequently out of the range of vision, seems to be lifted up into mid-air, and to hang suspended there —sometimes in its natural position, sometimes upside down, and sometimes both ways at once; the image in this latter case being doubled, like a ship and its reflection in the water. Secondly, there is that form of it where some object high up in the air, such as a cloud or a village on a hill, seems to be brought down and to lie floating in a vast lake stretching miles away at the spectator's feet. Thirdly, there is that less frequent form of it, where the setting sun appears to fling huge shadows of terrestrial objects far out into space.

Of the first kind of mirage there are some very striking instances on record. While sailing in the Polar seas, Captain Scoresby saw the inverted image of a ship, apparently suspended in the air, some miles distant. It was, he writes, so well defined that I could distinguish by a telescope every sail, the general rig of the ship, and its particular character, insomuch that I pronounced it to be my father's ship, which it afterwards proved to be; though on comparing notes with my father

when we met, I found that our relative position at the time gave our distance from one another very nearly thirty miles, being about seventeen miles beyond the horizon, and some leagues beyond the limit of direct vision. An English ship, while cruising in the Baltic, saw a similar mirage of the whole British fleet, consisting of nineteen sail. Here, again, the distance between the vessels was found to be full thirty miles. In both these instances the objects seen were inverted. At Hastings, on the south coast of England, a more striking example of mirage was witnessed. The whole of the coast of France, from Calais to Dieppe, though more than fifty miles distant, and quite out of the range of ordinary vision, seemed to be lifted up into mid-air, and was seen there, not inverted, but in its natural position, during the space of three hours, by hundreds of persons assembled upon the beach. The most remarkable instance of all, however, is that from Ramsgate, the four turrets of Dover Castle may be seen on a fine day over the top of an intervening hill. While looking in this direction one evening, the whole castle was seen, not lifted up in the air above the hill on the other side, but to all appearances brought over bodily on this side of it. So strong was the image, that the hill could not be seen through it. The double mirage is seen oftenest on the shore of the Straits of Messina, where the phenomenon is known as the Fata Morgana. The images of men, horses, houses and ships are projected into the air, feet to feet, or keel to keel, as the case may be, until the atmosphere looks like one huge lake, in which all these miscellaneous objects are seen floating about together.

The second kind of mirage—that, namely, in which the object is brought down instead of being elevated—is most frequently seen in the arid deserts of Lower Egypt, where it often proves cruelly deceptive to the thirsty traveler. Dotted about the waste are elevations, on which the natives have built their villages, in order that they may be safe from the flood during the periodical inundations of the Nile. In the heat of the day, the mirage brings down an image of the sky upon the level, some few miles in front of the caravan, and produces the effect of a broad expanse of water, in which each village, brought down also, appears as an islet. Lured on by the refreshing prospect, man and beast push hopefully forward, often miles out of their track, to find the waters and the islands constantly receding from their view, until the evening comes, and they vanish altogether. So complete is the delusion, that not only experienced and scientific travelers, but even the Arabs themselves, are often deceived by it.

To produce the third illusion, the observer must be above the level of the reflecting surface. A stratum of denser air being above the

AN EXTRAORDINARY SPECTACLE IN THE ARCTIC REGIONS.

eye, as is sometimes the case at sea, then a phenomenon, such as the reflection of a steamer, is caused. The reader will readily conceive the philosophy of this, if a plate of glass be imagined to exist parallel to the surface of the sea at the height of the reflected ship. Thus we should see the vessel upside down, and the stratum of denser air has precisely the same effect.

The double reflection of the three-masted ship is somewhat more complicated. The vessel itself is almost below the horizon, and, indeed, the reflection in the sky of a ship thirty or forty miles distant has been seen. This certainly is one of the marvels of human vision.

The inverted reflection is due to the same cause as that of the steamer. In each of these cases, as in all cases of reflection, only some of the rays of light were reflected or thrown back from the surface—the rest passing into the upper stratum; and if we could have risen in a balloon, in all probability we should have been able to reach these rays, and thus have seen the other image of the steamer upright, and keel to keel with the inverted image. In the case of this ship, the reflecting surface happens to be in the right position for the observer not only to catch the first reflection, but the rays which entered the upper layer are refracted, or bent down, and thus the second image becomes visible.

STRANGE VISIONS IN THE DESERT.

Eastern travelers often tell scarcely credible tales of the mirage of the desert. Suddenly in the distance, where all is known to be arid sand, appears a sheet of water. Here and there upon its bosom lie enchanted islands, above the top of whose woody groves rise the turrets of castles, or minarets of mosques. So real is the sight, that men and camels push forward, longing to bathe in the refreshing waters of this fairy lake; but as they advance, the mirage retreats, and all fades as the sun sinks beneath the lurid horizon. The explanation of the phenomenon is this: that the sand, being intensely hot, causes the layer of air which rests upon it to become greatly rarefied; and under certain circumstances this layer is quite distinct from the denser stratum a few inches or feet above it—just as if it were a sheet of water upon which oil rested, the surface at which the two layers meet being quite sharply defined.

This explanation will, in some measure, account for that illusion which is occasionally seen on the Straits of Messina. The Italians called it the Fata Morgana. It is thus described by one who was fortunate enough to witness it: As I stood at my window, I was surprised with a most wonderful delectable vision. The sea that washes the Sicilian shore swelled up for the distance of ten miles, like a chain of dark mountains; while the waters near the Calabrian shore grew quite smooth, and, in an instant, appeared as one clear, polished mirror, reclining against the

aforesaid ridge. On this glass was depicted a string of several thousands of pilasters, all equal in altitude, distance and degree of light and shade. In a moment they lost half their height, and bent into arcades like Roman acqueducts. A long cornice was next formed on the top, and above it rose castles innumerable, all perfectly alike. These soon split into towers, which were shortly after lost in colonnades, and, at last, ended in pines, cypresses, and other trees, even and similar. This was the Fata Morgana, which for twenty-six years I had thought a mere fable, but found to be a picturesque and pleasing reality.

STARTLING EFFECTS OF FROST.

During one of Franklin's voyages, the winter was so severe, near the Coppermine River, that the fish froze as they were taken out of the nets; in a short time they became as solid as ice, and were easily split open by a blow from a hatchet. If, in the completely frozen state, they were thawed before the fire, they revived. This is a very remarkable instance of how completely animation is sometimes found suspended in the case of cold-blooded animals. The common leech is said to be capable of resisting the effects of a low temperature to a wonderful degree. It is said that once a group of these animals left accidentally in a closet without a fire, during the severe frost of the year 1816, not only survived, but seemed to have experienced no injury, although they had been imbedded in a solid mass of ice for many days.

A celebrated Arctic traveler states that all animal substances, fish excepted, may be preserved in Greenland for any length of time without being smoked, dried or salted. Beef, mutton, pork and fowls, the latter neither plucked nor drawn, are constantly taken out from the northern islands of Scotland, and preserved in this way. When used, the beef is divided by a saw; it is then thawed in cold water, and if cooked when it is three, four or five months old, will frequently appear as profuse of gravy as if it had been recently killed. A further antiseptical effect is produced by the cold on animal and vegetable substances, so as to preserve them, if they remain in the same climate, unchanged for many years. Wood has been met with in Spitzbergen which has resisted all injury from the weather during the lapse of a century. A French writer relates also that the bodies of seven Dutch seamen, who perished in Spitzbergen in 1635, were found twenty years afterwards by some sailors who happened to land about the place where they were interred, in a perfect state, not having suffered the smallest degree of putrefaction. A similar phenomenon is recorded of the Mer de Glace in Switzerland, which engulfed several travelers, and many years afterward threw their bodies out in the valley below, the natural movement of the ice having carried them down. When water solidifies, or freezes, it expands, and

for this reason water-jugs and bottles, as well as the leaden supply-pipes, are often broken in severe weather by the formation of ice within them. The water in the vessel freezes at the top. No injury is done because there is nothing to hinder the expansion upwards. But if it freezes again, until the ice becomes so thick that it is more capable of resisting the expansive force than the glass or earthenware of which the vessel is composed, the latter will break. An artillery officer at Quebec made an experiment during a hard winter, by filling a bomb-shell, about fourteen inches in diameter, with water, and then closing the opening with an iron peg, which was driven firmly in. This being exposed to the severe frost, the stopper was driven out to a distance of more than one hundred yards, and a cylinder of ice, eight or nine inches long, came out of the opening. In a second experiment of the same kind, the stopper resisted the expansive force; but the shell itself was rent, and a ring of ice was forced through the crack all round the shell. In the same manner houses have been overthrown by the expansive force of frost in the earth causing the ground to swell up. Stones will break in consequence of the water they contain freezing, and trees have split up with an explosive sound on occasions of sudden cold occurring when their vessels have been full of sap.

An interesting experiment on the expansion of ice was made in Maine not long ago. The Kennebec River, near the town of Gardiner, is about seven hundred feet wide; the water is very fresh for many miles below, and the average ebb and flow of the tide is five feet; the depth of the water varies, according to the locality and state of the tide, from seventeen to twenty-five feet. In the course of the winter, the ice is always observed to crowd ashore, crumpling up in ridges on the flats, and near the edge of the channel. A row of stakes was planted in the ice, by boring holes through to the water, at distances of about one hundred feet apart, avoiding a very near approach to the shore. The distance between the eastern and western stakes was five hundred feet. A month later it was found that the outer stakes had advanced more than a foot, and the whole expansion was upwards of thirteen feet. The balloonist also meets with singular atmospheric facts.

WONDERFUL AERIAL VOYAGES.

The first balloon of Montgolfier, the discoverer of ballooning, was small, containing less than seventy-eight cubic inches of air. He made it rise to the roof of his apartment, in November, 1782. Certain, then, of the new principle, he made a balloon of considerable size, containing upwards of sixty-five feet of heated air. This machine likewise rose, tore away the cords by which it was at first held down, and mounting in the air to the height of from two to three hundred feet, fell upon the

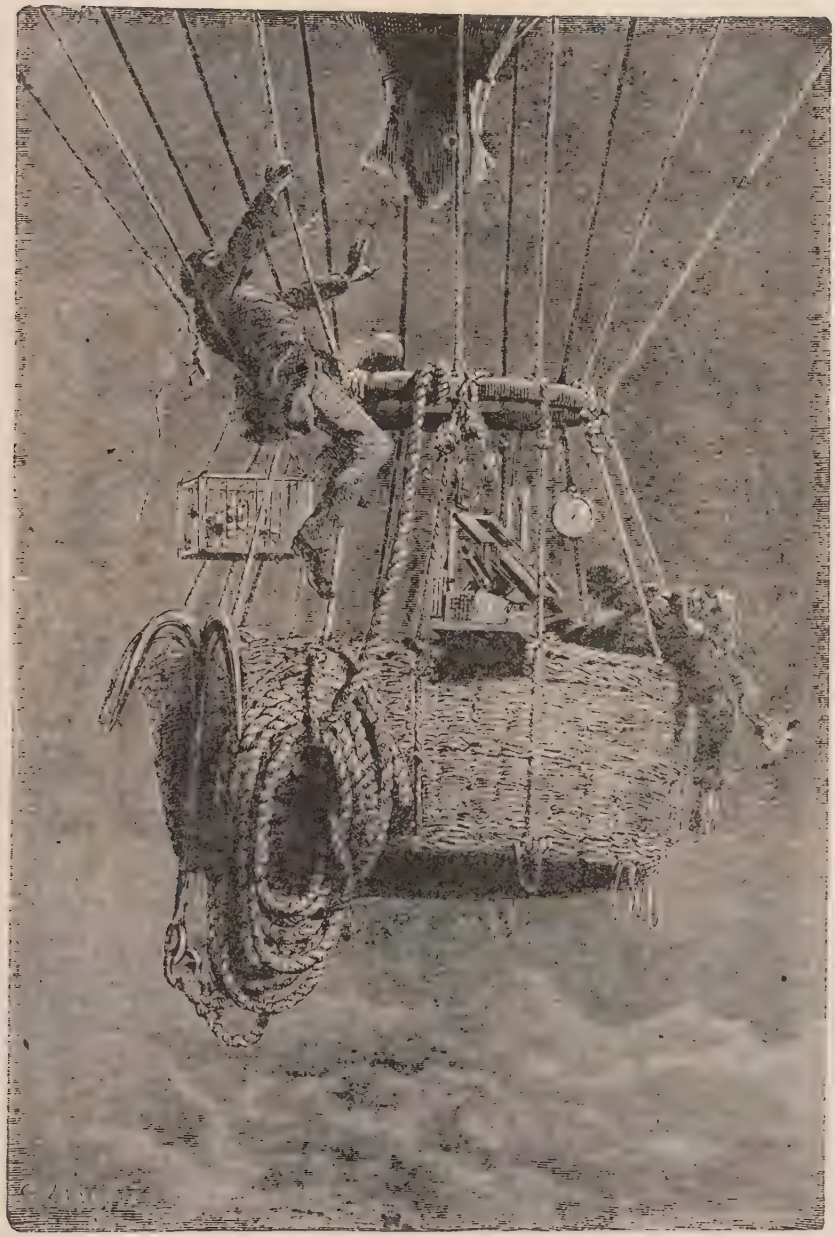
neighboring hills after a considerable flight. The brothers Montgolfier then made a very large and strong balloon, with which they wished to bring their discovery before the public.

On the appointed day, the nobility of the vicinity were invited to be present at the experiment. What was the general astonisment when the inventors of the machine announced that immediately it should be full of gas, which they had the means of producing at will by the most simple process, it would raise itself to the clouds! It must be granted that, in spite of the confidence in the ingenuity and experience of the Montgolfiers, this feat seemed so incredible to those who came to witness it, that the persons who knew most about it—who were, at the same time, the most favorably predisposed in its favor—doubted of its success. But the machine—which at first seemed only a covering of cloth, lined with paper, a sort of sack thirty-five feet high—became inflated, and grew large even under the eyes of the spectator, took consistence, assumed a beautiful form, stretched itself on all sides, and struggled to escape. Meanwhile, strong arms were holding it down until the signal was given, when it loosened itself, and with a rush rose to the height of one thousand fathoms in less than ten minutes. It then described a horizontal line, and as it had lost a considerable amount of gas, it began to descend quietly. It reached the ground in safety; and this first attempt, crowned with such decisive success, secured for ever to the brothers Montgolfier the glory of one of the most astonishing discoveries. Their rude apparatus has since been greatly improved.

A young man well versed in physics, Professor Charles, assisted by two practical men, the brothers Robert, threw himself ardently into the investigation of the modes of inflating balloons with hydrogen gas, which was then called inflammable air. Guessing that it was much lighter than that which Montgolfier had been obliged to make use of, Charles leagued himself with his two assistants to construct a balloon of taffeta, twelve feet in diameter, covered with india-rubber, and to inflate it with hydrogen.

The inflation with hydrogen was effected in a very curious manner. As much as eleven hundred and twenty-five pounds of iron and five hundred and sixty pounds of sulphuric acid were found necessary to inflate a baloon which had scarcely a lifting power of twenty-two pounds, and the process of filling took no less than four hours. At length, however, at the end of the fourth hour, the balloon, composed of strips of silk, coated with varnish, floated.

The conveyance of the balloon to the Champ de Mars was a most singular spectacle. A vanguard, with lighted torches, preceded it; it was surrounded by special attendants, and was followed by detachments



A WONDERFUL ASCENSION OF SEVEN MILES FROM THE EARTH.

of night-patrols on foot and mounted. The size and shape of this structure, which was escorted with such pomp and precaution—the silence that prevailed—the unearthly hour, all helped to give an air of mystery to the proceedings. At last, having passed through the principal thoroughfares, it arrived at the Champ de Mars, where it was placed in an inclosure prepared for its reception. When the dawn came, and the balloon had been fixed in its place by cords, attached around its middle and fixed to iron rings planted in the earth, the final process of inflation began. The Champ de Mars was guarded by troops, and the avenues were also guarded on all sides. As the day wore on an immense crowd covered the open space, and every advantageous spot in the neighborhood was crowded with people. Later, the report of a cannon announced to the multitudes, and to scientific men who were posted on elevations to make observations of the great event, that the grand moment had come. The cords were withdrawn, and, to the vast delight and wonder of the crowd assembled, the balloon shot up with such rapidity that in two minutes it had ascended four hundred and eighty-eight fathoms. At this height it was lost in a cloud for an instant, and, reappearing, rose to a great height, and was again lost in higher clouds. The ascent was a splendid success. The rain that fell dampened neither the balloon nor the ardor of the spectators.

The fall of the balloon was caused by the expansion and consequent explosion of the hydrogen gas. This event took place some distance out in the country, close to a number of peasants, whose terror at the sight and the sound of this strange monster from the skies was beyond description. The people assembled, and two monks having told them that the burst baloon was the hide of a monstrous animal, they immediately began to assail it vigorously with stones, flails, and pitchforks. The curé of the parish was obliged to walk up to the balloon to reassure his terrified flock. They finally attached the burst envelope to a horse's tail, and dragged it far across the fields.

A somewhat humorous result of all this was the issue of a communication from government to the people, entitled, "Warning to the People on Kidnapping Air-balloons." This document, duly signed and approved, describes the ascents at Annonay and at Paris, explains the nature and the causes of the phenomena, and warns the people not to be alarmed when they see something like a "black moon" in the sky, nor to give way to fear, as the seeming monster is nothing more than a bag of silk filled with gas.

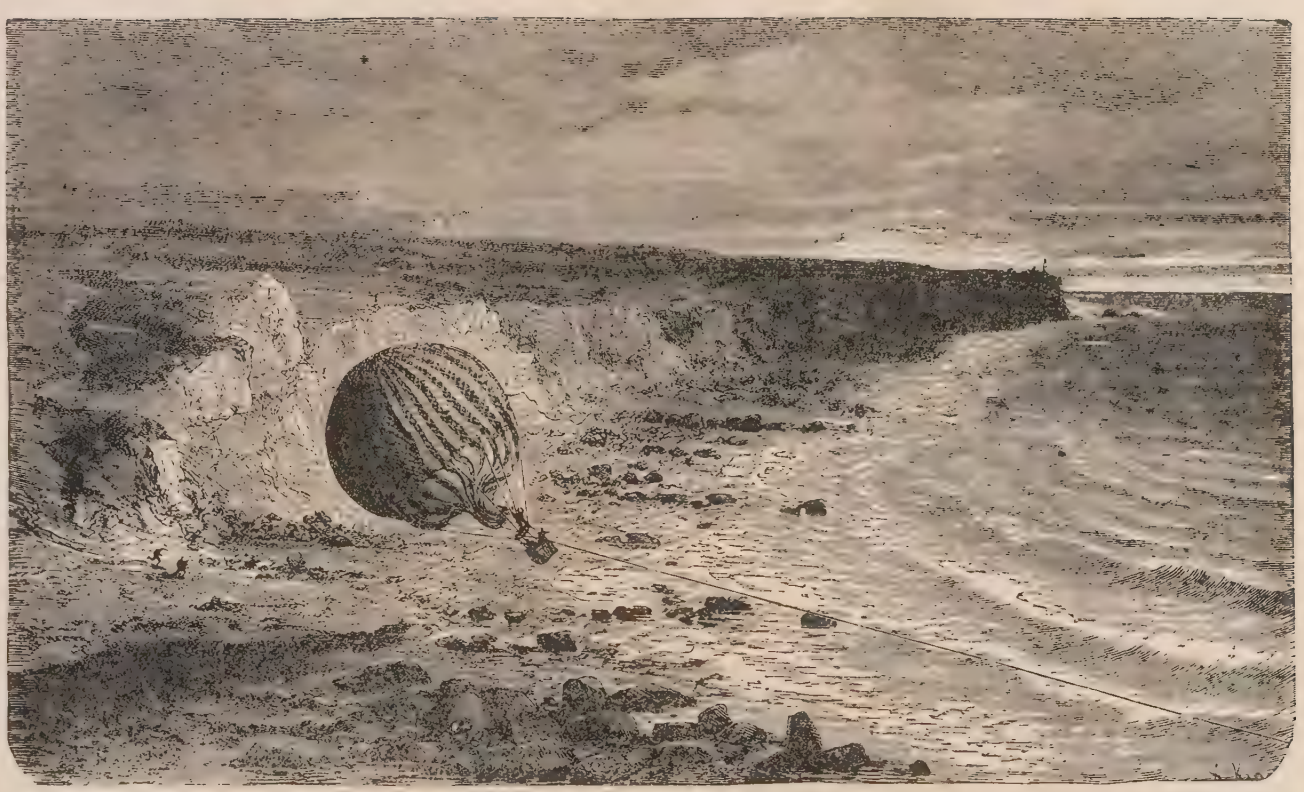
The most remarkable excursion ever known was that superintended by Green, from London to Germany. This journey, twelve hundred miles in length, is the longest that has been yet accomplished. Not

knowing to what quarter of the globe he might be blown, Green provided himself with passports to all the states of Europe, and with a quantity of provisions sufficient to last him for some time, should he be driven by the wind over the sea. Shortly after mid-day the balloon rose with great grandeur, and, urged by a light breeze, floated to the south-east over the plains of Kent. Later the voyagers sighted the sea.

In an hour the Straits of Dover were cleared, the lights of Calais shone out toward the voyagers, and the sound of the town drums rose up toward them. Darkness was now complete, says the writer, and it was only by the lights, sometimes isolated, sometimes seen in masses, and showing themselves far down on the earth beneath us, that we could form a guess of the countries we traversed, or of the towns and villages which appeared before us every moment. The whole surface of the earth for many leagues round showed nothing but scattered lights, and the face of the earth seemed to rival the vault of heaven with starry fires. Those on the horizon gave us the notion of a distant conflagration. In proportion as we approached them, these masses of lights appeared to increase, and to cover a greater space, until, when right over them, they seemed to divide themselves into different parts, to stretch out in long streets, and to shine in starry quadrangles round the squares, so that we could see the exact plan of each city, given as on a small map. At midnight a black profound abyss surrounded us on all sides, and, as we attempted to penetrate into the mysterious deeps, it was with difficulty we could beat back the idea and the apprehension that we were making a passage through an immense mass of black marble, in which we were inclosed, and which, solid to within a few inches of us, appeared to open up at our approach.

Until three o'clock the voyagers were in this state. The height of the balloon, as calculated by the barometer, was two thousand feet. They had not then anything to fear from a disastrous encounter, when all at once a sudden explosion was heard, the silk of the balloon quivered, the car received a violent shock, and seemed to be shot suddenly into the gloomy abyss. A second explosion and a third succeeded, accompanied each time by this fearful shock to the car. The travelers soon found out that, owing to the great altitude, the gas had expanded, and the rope which surrounded it, saturated with water, and frozen with the intense cold, had yielded to the pressure, in jerks which caused the report and the shock.

At seven in the morning the voyagers made their descent in the Duchy of Nassau. They received a most flattering reception, and, in memory of the event, they placed the flag which they had borne in their car during their adventurous excursion in the ducal palace. Thus



PERILS OF THE DESCENT—THE BALLOON DRIFTING.

terminated an expedition which, whether we regard the extent of the journey, the length of time occupied in it, or the results which were the objects of the experiment, may justly be considered as one of the most interesting and most important ever undertaken. After having traversed without hindrance, without either danger or difficulty, so large a portion of the European continent, they arrived at their destination still in possession of as much force as might have carried them round the whole world. This shows that very long voyages may be made.

Repeatedly the balloon has been turned to practical account, and has been made useful in warfare. In the Franco-German war Gambetta ascended from Paris when it was so surrounded by the enemy that there were no other means of escape, and landing outside, attempted to afford relief to the beleaguered city.

During the late Civil War, the part which the balloon played was a more important one. The Government conferred the title of aeronautic engineer upon Mr. Allan, of Rhode Island, who originated the idea of communicating by a telegraphic wire from the balloon to the camp. The first telegraphic message which was transmitted from the aerial regions is that of Professor Love, at Washington, to the President of the United States. The following is this despatch: "Sir.—The point of observation commands an extent of nearly fifty miles in diameter. The city, with its girdle of encampments, presents a superb scene. I have great pleasure in sending you this despatch—the first that has been telegraphed from an aerial station." In the month of September, 1861, one of the most hardy aeronauts furnished important information to General McClellan. The balloon of La Mountain, which arose from the northern camp upon the Potomac, passed above Washington. La Mountain then cut the cord that connected his balloon with the earth, and rising rapidly to the height of a mile and a half, he found himself directly above his enemy's lines. There he was able to observe perfectly their position and their movements. He then threw over ballast, and ascended to the height of three miles. At this height he encountered a current which carried him in the direction of Maryland, where he descended in safety. General McClellan was so much satisfied with the observations taken in the balloon, that, at his request, the order was given to the War Department to construct four new balloons, to be used in conducting military campaigns.

THE TERRIBLE CYCLONE.

Cyclone is the name given to a revolving storm of wind. A revolving storm is simply this:—A stratum of hot air, made hot by contact with the hot earth, and by the power of the sun, is overlaid by a stratum of cold air. From the greater weight of the cold air the natural ten-

dency of the hot air to rise is restrained; some cause, local or general, forces an intermixture of the two strata at a particular point, and establishes the nucleus of the storm. The intermingling of the unwilling elements gives rise to considerable atmospheric disturbance, and the particles of air rubbing against one another get whirled round in a direction suggested by the motion of the earth at the place of disturbance; the example set is followed by adjacent blocks of air; and great bodies of wind, co-extensive with the masses of hot and cold air, are set in motion, taking their revolving rate and direction from the heat or nucleus of the storm. The storm acquires strength in rolling, until the whole attains a circular velocity in severe hurricanes of one hundred miles an hour. But the storm travels, that is to say it has two motions, its own circular motion at the rate just mentioned, and also the direct motion of the wind prevailing outside its circumference at the time. The whole body of the storm is moved along, still gyrating, at the rate of the general wind, and is borne onward always in its direction.

TREMENDOUS POWER OF THE WIND.

Cyclones last only from fifty to sixty or seventy seconds, their breadth varies from a few rods to several hundred yards, and it is probable that the length of their track rarely exceeds twenty-five miles This phenomenon is usually preceded by a calm and sultry state of the atmosphere, when suddenly the cyclone appears, traversing the earth with great velocity, and sweeping down by its tremendous power the mightiest products of nature, and the strongest works of man. Ponderous bodies are whirled aloft into the air; trees of large dimensions twisted off or torn up by the roots; buildings of the firmest construction prostrated, and streams whirled from their beds and their channels laid bare. A cyclone that occurred in Silesia, carried a mass weighing more than six hundred and fifty pounds fifty feet above the top of a house, and deposited it on the other side in a ditch, one hundred and fifty paces distant.

In one which happened at Maysville, Ohio, a barn containing three tons of hay and four horses, was lifted entirely from its foundations. And such was the force of the wind during a tornado which occurred at Calcutta that a bamboo was driven quite through a wall five feet thick, covered with masonry on both sides; an effect which was estimated, by a person on the spot, to be equal to that produced by a cannon carrying a six-pound ball. By the action of a tornado, fowls are often entirely stripped of their feathers, and light substances carried to a distance varying from two to twenty miles. In the West Indies hurricanes almost always begin from some point eastward of Barbadoes, whence they proceed in a north-westerly course till the resistance of

the land and their own exhaustion cause them to flag. Their track is marked by ravages the most terrible and desolating it is possible to imagine. The great hurricane which swept the West Indies in August, 1831, destroyed, in the space of seven hours, in Barbadoes alone, no less than one thousand four hundred and seventy-seven lives and many thousand of dollars worth of property; it carried destruction the most complete along a course extending many hundreds of miles, and was not checked till it had made its way some distance inland on the continent of this country. Trees of seventy feet in height were uprooted, houses were blown down as if made of cardboard, men were blown through the air to some distance, and guns in the fort were dismounted and flung down many yards away from where their carriages stood. The tremendous force of the wind piled up the waters so that they stood in a heap in Carlisle Bay, and ships that had been anchored half a mile from the landing-place were floated and driven half a mile inland and put down in cane-fields, or in what had been cocoa-nut groves. Storms of some violence are not unfrequent in the West Indies, but hurricanes of great fury are specially remembered, and people take them for chronological guides, speaking of what happened in such a year after the "wind."

One remarkable fact in connection with these circle-going storms is the shifts of wind which occur at the places over which they pass. The wind that has been blowing furiously from south-west suddenly drops, there is a treacherous lull for a few minutes, and then, just as the inexperienced in such things fancy that the tyranny is overpast there comes a dreadful blast from the north-east, with power equal to that which so lately made signs of giving up its wild sport. A cross sea is set up, in which it is scarcely possible for a ship to live, and in the trough of which, if she be allowed to fall into it, she must inevitably be drowned.

THE REMARKABLE TRADE WINDS.

That there should be a wind ever constant from the same quarter all the year round, is, apart from the causes of it, a wonderful fact. Columbus first discovered the full extent of the trade winds, when he made his first voyage to this country. Previously he had observed in the neighborhood of the Canaries the frequency of the winds from the same quarter, but it was not till he set out on his first American voyage that he ascertained the extent over which they regularly prevail. The story is well known about the anxiety of Columbus's crew, how they noticed, when well to the westward of Grand Canary, the perpetual breeze from north-east; how they expressed their fears about getting back to Europe, declaring that God was angry with them for presuming to pry into His secrets in the west, and had given them over to the power of the devil

who caused a wind to blow which should ever prevent their return to Spain. Columbus, while he succeeded in overcoming the fears of his sailors, and taught his successors how to sail round the wind which he could not sail against, never seems to have understood the cause of the phenomenon, which, since his time, has been fully discovered.

So far as the name is concerned, it may be pretty safely concluded that it was given because the wind was the sure promoter of commerce, a wind upon which the merchant might certainly count to carry his ships over a known distance of the voyage. As regards the direction from which it blows, when the sun is south of the equator the wind has a little more north in it, and is variable between N. E. and N. N. E. When the sun is north of the line the wind is more easterly.

EXPLANATION OF THE WONDERFUL TRADE WINDS.

The extent of the trade wind region depends entirely upon the sun. When the sun has a southern declination, the trade wind is often not found till the twenty-seventh degree of north latitude; but with a northern declination of the sun the wind gets as far north as thirty-two degrees. Its influence is perceived at from two to seven degrees north of the equator, so that the district over which the wind blows may be estimated at about twenty-two degrees of latitude. The force of the wind is sufficient to propel a ship regularly at the rate of seven to eight miles an hour. It is the capital of commerce, and never fails.

The trade wind theory now accepted may be thus explained:—At either pole is a region of calms, estimated at from one to one and a half degrees in extent. Outside this is a district extending for many degrees over which prevail winds running from all directions towards the pole. Beyond this are the calms of Cancer and Capricorn, in the northern and southern hemispheres respectively; then the north-east and south-east trade winds, and between them the belt of equatorial calms and rains. Such are the facts. Now the rotary motion of the earth from west to east being kept in mind, it will be readily understood that a current of air coming from the north pole, where the earth's motion is scarcely felt, towards the equator, would, the further it traveled south, find itself more and more affected by the rotatory motion. The earth would be, as it were, slipping from under it, going from west to east, so that the current which was flying south would find that it did not go in a straight line, but would get sent away westward, and would blow, therefore, from the north-east; in the same way, the south wind coming north would be converted into a south-east wind.

Now the prevailing winds between the Polar calms and the calms of Cancer are winds which blow towards the pole, so that the current of air which blows towards the equator must overrun them—as, in fact, it

does till it reaches the thirtieth parallel of north latitude. There it meets with a counter-current of equal strength, and the two irresistible bodies meeting, cause a pressure or stagnation in the air at the point of contact, the stagnation produced being the calms of Cancer, which stretch over five or six degrees of latitude. Either opponent being unable to conquer, both descend—the north wind to pursue its southerly course to the equator, the south wind to fly onwards to the north pole The wind which the northern giant met at parallel thirty was a south-west wind, which had blown above and across the extent traversed by the north-east trade. Its history does not differ materially from that of its rival, except that at parallel thirty it has nearly done its travels, whereas the north wind is only just beginning. One wind has made the circuit of the globe, as the wind it meets will have to make the circuit. It has started from the south pole along the upper road (the phenomena of the southern hemisphere are like those of the northern), has encountered the strong north-east wind which overlies and overblows the south-east trades, has pushed against it so hard as to repeat at Capricorn what was done at Cancer, and has swept resistlessly over thirty degrees of latitude as the south-east trade wind. At so near the equator it has been met by the north-east trade wind. The two winds have been hurled at one another with a momentum acquired in a run over thirty degrees of latitude apiece, and have been forced to scale the heavens in order to avoid each other. Away they rush northward and southward respectively.

The conflict which takes place between the winds at the equator, if not more fierce than that which occurs at Cancer and Capricorn, has more visible effects. To it must be attributed those strange convulsions which often make the equatorial region anything but a calm one ; those fierce deluges of rain which sweep down from the clouds in sheets, that lightning and that thunder, which are the concomitants of the mighty battle that is being perpetually fought for the supremacy of north and south. The wind goeth towards the south and turneth about unto the north ; it whirleth about continually, and the wind returneth again according to his circuits. It is the great purifier of the earth. It is the foe of pestilence and all forms of disease, the source of life and health

COLORED SNOW AND RAIN.

Red snow is a phenomenon which is frequently observed in the Polar regions, and has occasionally been met in the Alps and in Scotland. Captain Ross discovered, on the shore of Baffin's Bay, a range of cliffs extending for eight miles, which were covered with a red snow of a brilliant hue, and sometimes as much as twelve feet in depth. The cause of the appearance was a puzzle to men of science as well as to

ATMOSPHERIC SPLENDORS—THE AURORA BOREALIS.

the observers, until careful examination with the microscope revealed that it was due to the presence among the snow of a very minute plant, whose cells were filled with animalcules.

There are on record several incontestable instances of black rain having fallen, among which the following may be mentioned: Professor Barker laid before the Royal Dublin Society some observations on a shower of black rain which had fallen around Carlow and Kilkenny, and extended over an area of more than four hundred square miles. He presented to the society a specimen which had been forwarded to him, the person who had collected it mentioning that at the time that it fell it was uniformly black, and resembling ordinary writing ink. Barker found, however, that after allowing it to stand for a short period, the black coloring matter separated from the water with which it had been mixed, rendering the color of the rain much lighter than at first. This shower was preceded by such darkness that it was impossible to read except by candle-light. After this darkness had continued for some time, a hail-storm occurred, attended with vivid lightning, but without thunder, and when this subsided the black rain fell. On examination of the rain just after it had fallen, it was found to have an extremely fœtid smell, and a very disagreeable taste; it left a stain upon some clothes on which it had fallen, and cattle refused to drink it. It fell in the afternoon, rendering quite black the people's clothes on the hedges, and those spread on the grass to dry; also giving to the water caught in tubs and vessels from slated and tiled houses, almost the color of ink. Some rain which had fallen in the morning had been perfectly clear, and the black rain appeared to fall from one particular cloud.

The material that mingles with these extraordinary rains is of a dark color, and imparts an inky blackness to the shower. A rain of this kind occurred at Montreal, in Lower Canada, on two several days. A dense gloom enveloped the city, while the whole atmosphere was obscured by a thick haze, of a dusky orange color, and at this time rain descended of a dark inky hue. The weather soon after became pleasant, and continued so until the following day, when at noon the whole city was again shrouded in a heavy, damp vapor, so dense that it became necessary to light candles in all the houses. Soon after, when the darkness was the deepest, the gloom was dispelled by a vivid flash of lightning, which was followed at once by a crashing peal of thunder; and this was succeeded by a heavy shower of thick, black, rain.

A storm of red hail is stated by Baron Humboldt to have once occurred at Paramo, in South America, between Bogota and Popayan. There likewise fell over all Tuscany in 1813, a shower of hail of an

orange hue. A hail-storm happened in Ireland in 1849, which deposited upon the ground a black, inky substance. Some of this dark matter was collected and examined, and found to be of the same nature as the coloring material of red rains. The air around us has its mysteries.

EXTRAORDINARY SHOWERS.

From time to time, and in regions of the globe widely separated from each other, dust in large quantities has descended from the heights of the atmosphere, not only upon the land, but also far out on the ocean, hundreds of miles from the shore. It is entirely distinct from that which is disseminated through the air by the winds, during the eruption of volcanoes, and for many years has been described, by observers and writers, under the various names of dust-storms, dust-rain, red fogs, Sirocco dust, African dust, sea-dust, Atlantic dust, and trade wind-dust. This dust not only falls dry, in the form of a fine, impalpable powder, but is occasionally mingled with rain, hail and snow, which it dyes with its own hue. As it is usually of a reddish color, these showers of rain and storms of hail and snow have received the appellation of blood-rains.

A shower of dust fell at Malta in 1830, and at the same time a similar fall occurred in the bay of Palmas, in Sardinia, while a Sirocco wind was blowing from a south-easterly quarter. The Maltese dust was of a brownish-red hue. Some of it was collected and forwarded to Mr. Charles Darwin, the eminent naturalist, for examination. In the year 1831, the ship "Beagle" was despatched by the British government on a voyage of scientific discovery around the world. Mr. Darwin accompanied the expedition, and during the voyage observed a dust-shower, near St. Jago, the chief of the Cape de Verd Isles. He collected a little package of impalpable brown-colored dust, which appeared to have been filtered from the wind by the gauze of the vane at the mast-head. In speaking of this phenomenon, he remarks, that the atmosphere in this region is usually filled with a haze, caused by the falling of this fine, brown-colored dust. By the kindness of a friend, Mr. Darwin received four parcels of dust which fell upon the deck of a vessel, a few hundred miles north of the Cape de Verd Isles.

Much valuable information respecting dust-showers on the ocean has been gathered by this gentleman, who has found fifteen different accounts of the descent of dust upon ships when far out on the Atlantic. It has often fallen upon them when they were several hundred, and even a thousand miles from the coast of Africa, and at points sixteen hundred miles distant in a north and south direction. In some of the dust collected upon a vessel three hundred miles from land, particles of stone were discovered, more than the thousandth of

an inch square, mixed with finer matter. It falls in such quantities as to soil every thing upon which it descends, and to irritate the eyes of persons exposed to it. Ships have even been known to run ashore, owing to the obscurity of the atmosphere resulting from the presence of this dust, widely diffused through the surrounding atmosphere.

During a voyage from Richmond, Virginia, to Rio Janeiro, in the winter of 1845–6, Mr. Thomas Ewbank, of the United States Patent Office, met with many instances of the falling of sea-dust, and traced the rich and peculiar hues, that at times adorned the clouds and sky, to the diffusion of this fine powder throughout the intermediate atmosphere. Once he observed a narrow belt of slate-colored sky skirting the horizon, while upon this rested a broad band of vermilion, interspersed with soft dashes of India ink, shaded with umber. These hues changed, by insensible degrees, into a bright, cream-color, and this again into a pale, delicate green, which deepened in tint as it approached the zenith, while over all floated amber-colored clouds, growing richer in hue and smaller in size as they sunk towards the horizon, painting the sky with the most delicate tints.

During the two following days the heavens presented scenes of gorgeous and surpassing beauty, the colors of the sky and clouds ranging through emerald green, pink, purple, crimson, yellow, chocolate, umber, and slate; while beneath this rich and varied combination a groundwork of the purest cream-color extended, giving tone to the whole, and changing in tint from a fawn-color to a pale white.

BRILLIANT PHENOMENA IN THE SKY.

The wonderful sunsets noticed within the last few years have been attributed to causes similar to those just mentioned. Tremendous volcanic action, especially in the island of Java, whereby immense quantities of dust have been thrown up, has been thought to account for the vivid colors of the heavens, the diffused substance acting as a reflector for the light.

Not merely have showers of dust and inorganic matter excited the wonder of men of science, but there have been showers of living organisms. In 1833, at Lake Gwynant, in the county of Caernarvon, a woman was engaged washing a pail at the edge of the lake, and a number of children were with her. While she was thus employed, a shower of small fishes fell partly into the lake, partly upon the land, close to where the woman was. The fish resembled herrings, but were much smaller. A heavy shower of rain had preceded the descent of these fishes, and the day following there was much rain and thunder. Soon after a most violent storm of rain and wind, three small crabs were found in the area of the workhouse at Reigate; and a fourth was

afterwards found at a little distance the following morning. One of them appeared to be still living. In the morning of the day previous to the storm the area of the workhouse had been thoroughly swept and cleaned; consequently they must have been seen had they been there then. They were found by a boy, who told the governor that he had found a comical sort of a frog. The inhabitants of the island of Isla, Argyleshire, after a day of heavy rain, were surprised to find numbers of small herrings strewed over their fields, perfectly fresh, and some of them exhibiting signs of life. Similar instances of showers of small fish are well authenticated. In a pasture-field in the parish of Stansted, which is a considerable distance from the sea or any branch of it, and a place where there are no fish-ponds, there were found fish in quantity about a bushel, supposed to have been rained down from a cloud, there having been at that time a great tempest of thunder, hail and wind. These fish were about the size of a man's little finger; some were small whitings, others like sprats, and some rather like smelts. Several of these fish were shown publicly at Maidstone and Dartford, Kent.

WONDERFUL METEOROLOGICAL INSTRUMENTS.

The pressure of the atmosphere is ascertained by the barometer. This instrument is of the highest importance in meteorology. Into a glass tube, about three feet in length, open at one end and closed at the other, mercury is poured until it is full; the open end being now closed by the finger, or any other means, the tube is inverted, and the lower end immersed in a vessel of mercury. When beneath the surface of the fluid the end is unstopped, and the column of mercury within the tube then settles down, until its summit is about thirty inches above the level of that within the vessel. The space above the column in the tube is a void, and is called the Torricellian vacuum, from Torricelli, the name of the Italian philosopher, who first constructed this instrument. The column of mercury within the tube is supported above the level of that in the vessel, by the upward pressure of a column of the atmosphere, having the same base as itself. Any increase in the density of the atmosphere will be denoted by an elevation of the mercury, and a decrease by its depression.

As the approach or departure of storms is always indicated by changes in the density of the atmosphere, the barometer becomes a sure indicator of the weather, the mercury rising or falling according to the atmospheric pressure. Density indicates humidity, and hence rain and storm; rarity, the opposite.

Since the constant changes in the weight of the atmosphere produce corresponding fluctuations in the height of the barometer, a scale is placed near the top of the tube, extending from twenty-seven to thirty-

one inches, a space which includes at the surface of the earth, all the fluctuations of the column. This scale is divided into tenths of an inch; but, as the variations of the barometer are exceedingly minute, a contrivance called a vernier is annexed, by which a change, to the extent of one-five hundredth of an inch, can be easily measured.

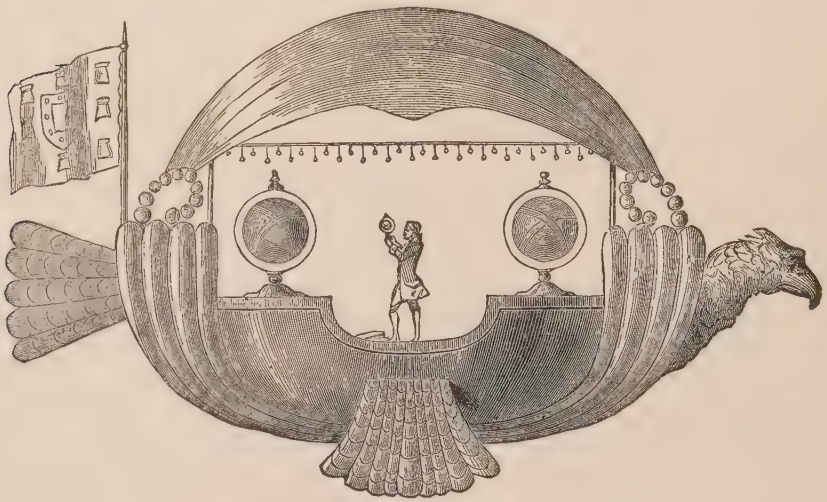
The temperature of the atmosphere is indicated by the thermometer. It consists of a small glass tube, terminated by a bulb, and is partially filled with mercury. This fluid is usually preferred for several reasons, the most important of which are, its uniform dilation, its quick susceptibility to any change in temperature, and the great range of its expansion in the fluid state. If the instrument is to be exposed to extreme cold, alcohol must be used. As mercury, like other fluids, expands by heat, and contracts by cold, its alternate elevations and depressions within the tube can be made to indicate the corresponding changes in the state of the air, if two fixed temperatures can be found, whence to reckon the changes. These have been discovered. If a thermometer is immersed at different times in melting snow, the column of mercury invariably sinks to the same place in the tube, though many months may have elapsed between the experiments; and, when exposed to the steam of boiling water, the mercury always ascends to the same height under the same atmospheric pressure, vibrating with remarkable uniformity.

FLYING MACHINES—ATTEMPTS TO TRAVEL WITH WINGS.

The first attempt at flying occurred early in the sixteenth century, when an Italian adventurer visited England. He was very favorably received by James IV. of Scotland, and having promised to gratify the Court with the exhibition of a plan which would enable any person to visit the most distant regions in a few hours, he had an apparatus made consisting of huge wings, to be propelled by cords. Thus equipped, the adventurer leaped from the wall of Stirling Castle, and, as might have been expected, speedily reached the ground. His reasoning on this unlucky result is worthy of being preserved: My wings, said he, were composed of various feathers; among them were the feathers of a dunghill fowl, and they, by a certain sympathy, were attracted to the dunghill on which I fell; whereas, had my wings been composed of the feathers of eagles alone, as I proposed, the same sympathy would have attracted my machine to the higher regions of the air. This sophistry is at least ingenious.

A newspaper in 1709 contains a curious description of a Flying Ship, stated to have been invented by a Brazilian priest, of which we give an illustration, copied from an old cut. The ship, which at both ends was scallop-wise, had sails which turned as they were directed; there were two wings to keep the ship upright, and a stern to govern it. In the

body, at each end, was a pair of bellows, to be blown when there was no wind; two globes of metal, to cover two loadstones to draw the ship after them; the body was of thin iron plates covered with straw mats for ten or twelve men besides the constructor. Above the body was a network of iron wire, on which were fastened large amber beads, which, by a secret operation, would help to keep the ship aloft; also by the sun's heat the mats that lined the ship would be drawn towards the amber beads. The artist, by the help of the celestial globe, a sea-map and compass, was to take the height of the sun, thereby to find out the spot of land over which they were on the globe of the earth. There were pulleys and ropes to hoist or furl the sails; but we do not find that the design was at all practicable. The inventor was a visionary.



THE FAMOUS FLYING SHIP.

Doctor Darwin proposed to use wings similar to those of a bird, and to these motion was to be given by a gigantic power worked by high-pressure steam. The details of his plan were not fully drawn out; but a few years afterwards Sir George Cayley attempted to show, by reference to mathematical data, that a flying chariot might readily be constructed so as to rise in the air. We believe this ingenious inventor expended a large sum of money in endeavoring to mature his plans, but they ended in failure.

The Abbé Deforges, of Etampes, announced in the journals in 1772 that he would perform the great feat. On the appointed day multitudes of the curious flocked to Etampes. The abbé's machine was a sort of gondola, seven feet long and about two feet deep. Gondola, conductor, and baggage weighed in all two hundred and thirteen pounds. The

pious man believed that he had provided against everything. Neither tempest nor rain should mar his flight, and there was no chance of his being upset; whilst the machine, he had decided, was to go at the rate of thirty leagues an hour. All his calculations were fully made.

The great day came, and the abbé, entering his air-boat amidst the applause of the spectators, began to work the wings with which it was provided with great rapidity. But, says one who witnessed the feat, the more he worked, the more his machine cleaved to the earth, as if it were part and parcel of it.

THE WONDERFUL FLYING MAN.

Retif de la Brétonne, in his work upon this subject, gives the picture of a flying man, furnished with very artistically designed wings, fitting exactly to the shoulders, and carrying a basket of provisions suspended from his waist. To wings aerial adventurers mostly adhered. The Marquis de Racqueville flew from a window of his hotel, on the banks of the Seine, and fell into a boat full of washerwomen on the river. All these unfortunate attempts were lampooned, burlesqued on the stage, and pursued with the mockery of the public. Up to this time the efforts of man to conquer the air had miscarried. They were conducted on a wrong principle, the machinery employed being heavier than the air itself. But, even before the time of Montgolfier, the principles of aerostation began to be recognized, though nothing was actually done in the way of acting upon them. Thus, in 1767, Professor Black, of Edinburgh, announced in his class that a vessel, filled with hydrogen,

would rise naturally in the air; but he never made the experiment, regarding the fact as capable of being employed only for amusement. Finally, Cavallo, in 1782, communicated to the Royal Society of London the experiments he had made, and which consisted in filling soap bubbles with hydrogen. The bubbles rose in the atmosphere, the gas which filled them being lighter than air.

In the higher regions of the atmosphere, the union of warm and cold air, when the combining volumes are over saturated, will appear in the form of clouds. During the daily process of evaporation, warm, humid currents of air are continually ascending from the earth; the higher they ascend, the colder is the atmosphere into which they enter; and, as they continue to rise, a point at length will be attained, where, in union with the colder air, their original humidity can no longer be retained; a cloud will then appear, which increases in bulk with the upward progress of the current into colder regions. If the cloud, however, in its ascent, either meets with a warmer stratum of air, or descends towards the earth into a region of a higher temperature, a portion of the minute globules of water which compose it, perhaps all, will be re-dissolved, and the cloud will either contract in size, or completely vanish, according to the increase of heat to which it is subjected.

The effect of a screen in checking radiation, and thus preventing frost, has been finely illustrated by experiments in India. Throughout the whole region of Upper India, ice is artificially procured by placing upon a layer of dry straw, in the bottom of small pits, and fully exposed to the clear sky, broad, shallow earthen pans, filled with water. Such is the radiation during the night, that a thin crust of ice will sometimes form upon the water, when the temperature of the air on a level with the pits is ten degrees above the freezing point.

CHAPTER VI.

WONDERS OF ANIMAL LIFE.

Wonderful Provision for Animal Wants—Fur, Nails and Feathers—Beautiful Arabian Horses—War Chargers—Equine Intelligence—His Majesty King Leo—The Polar Reindeer—Great Irish Deer—The Musk Ox—The Yak—The Spry Syrian Goat—The Fleet Kangaroo—Wild Animals of the West—"The Ship of the Desert"—The Wild Ass—The Long-Clawed Aye-aye—Sly Reynard—A Four-Footed Fisherman—The Jerboa—A Long-Nosed Animal—White Monkeys—The Odd Mandrill—White Elephants—The Elephant's Sagacity—The Hugh Mammoth—A Gigantic Tortoise—Polar Bears—Grizzly Bear of California—The Seal—An Animal Charmed with Music—The Monstrous Sea-Horse—The Alligator—The Hard-Shelled Armadillo—A Wonderful Dog—Intelligent Cats—An Animal that Dies from its Own Bite—Leeches in Ceylon—Darwin's Crab—Construction of Animals.

NATURE has provided with admirable care and in an infinite number of ways for all the wants of the animal creation. To the animal of a mild and peaceable character, to which fighting and struggling against too redoubtable adversaries is forbidden, she has provided the means of avoiding and escaping from its enemies. Some are marvelously organized for running, as the hare and the gazelle. Others hide themselves in subterranean retreats, which serve them at the same time as barns, in which to preserve their provisions against the winter: such are the rat, the marmot, and others. Others, like the armadillo, present to their adversaries an invulnerable cuirass. Some, erecting their bristles, as the porcupine, present to the enemy a forest of spikes. There is not one animal, however weak it may be, which has not its artifices and means of defence against its most terrible enemies. If it were otherwise, all of the more feeble creatures would have been long since exterminated.

The clothing which grows from the bodies of animals is always suitable in quality and quantity to the climate and season under which they live. In hot climates the coat of quadrupeds is short and thin, but it thickens with increasing latitudes, and yields soft and abundant fleeces. At the poles it is externally shaggy and coarse, internally shorter and fine, as in the skin of the Arctic bear. How defensive is the fur of amphibious animals, the beaver, for example! How abundant and smooth upon birds are feathers, shutting up the heat of their warm blood, and opposing no resistance to the air through which they fly! The

birds of very cold regions have plumage almost as bulky as their bodies; and those which live much in the water have additionally both a defence of oil on the surface of the feathers, and the interstices of the ordinary plumage filled with delicate down—a bad conductor, which abounds particularly on the breast, as it, in swimming, first meets and divides the cold wave. Then there are animals with warm blood which live in the water—for example, the whale, seal, and walrus; but neither hair nor feathers oiled would have been a fit clothing for them. They accordingly derive protection from the cold water by the enormous amount of blubber or fat which surrounds their bodies, and acts as a non-conductor.

As a general rule, the hair of the animals falls off about spring or autumn, and is then replaced by new hair; this is what is called the shedding of the coat, which in some species takes place twice in the year. The scales, nails, horns, flakes of whalebone, which certain animals have, may be regarded as so many different forms of tegumentary appendages of the same nature as hair. The general form of the body is determined by the shape of the bony skeleton. The form of the skull varies exceedingly. Some have on the head or on the nose certain horn-like appendages. These appendages are sometimes merely the result of a very close conjunction of the roots of the hair, and are thus appendages to the skin; such is the case with the horn or horns upon the face of the rhinoceros. In other cases the horns are placed on the skull itself, and are appendages to the skeleton, though covered by the skin.

Beginning our description of animals with the horse—none the less a marvel in many respects because he is an object so familiar—we shall find abundant occasion for wonder in the lower forms of animal life. It is only in Arabia where the horse is found bordering on perfection. Here he is remarkable for a small head with pointed ears, peculiarly clean, muscular limbs, a corresponding delicate, slender shape, rather small size, and large animated eyes, expressing that intelligence which, as in the dog, is the consequence of being constantly with the members of his master's family—in fact, he generally shares their meals. He is frequently allowed to frolic through the camp like a dog; and at other times he is hitched at the entrance of the tent. He is exposed to the weather at all times; and, compared to the treatment of his species in America, he is scantily fed. A meal after sunset, consisting of barley, in some parts of the country, and camel's milk in others, or a paste of dates and water, sometimes mixed with dried clover and other herbs, constitute his usual sustenance; but on any extraordinary exertion being required, flesh is frequently given, either raw or boiled.

The Bedowins count five noble breeds of horses, all, as they say,

derived originally from the desert region of Arabia. Of these there are many branches; and there are other breeds which are considered secondary. The catalogue of distinct breeds in the desert is almost endless, and the pedigrees of individuals are verified by certificates which are handed down from father to son with infinite care; and not unfrequently they belong to more than one family; for there is often a copartnership in mares, and hence arise the difficulties attending the purchase of one.

While General Grant was on his celebrated tour round the world, the Sultan of Turkey, wishing to make him a present worthy of both the giver and the recipient, presented him with a fine pair of Arabian horses, which were exhibited in this country.

The remote epoch to which we can trace back the horse being employed as a domestic animal renders it very difficult to determine its original country. At the present day, we are generally led to consider the horse as originally a native of Asia, and that it appeared for the first time either on the vast central plateau which occupies so large a space in this quarter of the globe, or on the steppes to the north-east of the Caucasus. As the originally wild horse does not exist in any country, it is quite as impossible to recognize its primeval traces in historic times as to state with any certainty the native country of the first oxen, the first goats, the first pigs, the first sheep, or the first dogs.

There are, however, droves of horses free and unowned, living on the plains of Asia and the pampas and prairies of this country; but all zoologists agree in considering them as the descendants of certain domestic races, somewhat modified in their shape and habits by having returned to a state of liberty. At the date of the discovery of the New World, it is certain that no animal of the horse genus existed here; at the present day, on the contrary, we find immense hordes of them, which, through their wild and exposed life, have lost many characteristics which were possessed by their progenitors. These horses, called tarpans, mustangs and parameros, according to locality, live most frequently in bands of fifteen to twenty, of which only one is a mature male. In the pampas of Paraguay, however, the droves are sometimes composed of more than ten thousand animals. They are controlled by chiefs, who always lead them in traveling as well as in escaping pursuit, and each drove inhabits a particular district, which it defends against the invasion of strangers, and does not abandon unless obliged by deficiency of pasturage, or by the attacks of some of the larger carnivora. The migration of wild horses crossing the wide plains of the New World, almost shaking the ground under their measured tramp, is a spectacle to delight the traveler. Divided into squadrons composed

of a stallion and his attendants, the column progresses, preceded by their scouts. If these droves should meet with domestic horses, they invite them by neighings to regain their lost liberty and join their wandering phalanx, a request too frequently accepted. Spaniards and Indians capture wild horses by surrounding and forcing a drove to enter an inclosure, called a coral, where a horseman, armed with a lasso (a long strip of green hide, provided with a noose at one end) or the balleros (two balls connected by a cord) is placed. In Mexico the former implement is used, in lower South America the latter, and the skill and address with which these people entangle and throw the objects of their pursuit are truly surprising. However violent and protracted the struggle, the victim must ultimately succumb, when a leather strap with a slip noose having been placed round its lower jaw, or a villainously cruel Spanish bit in its mouth, an Indian mounts. After making vain efforts to get rid of the man, the horse sets off at full gallop, stimulated moreover by the spur. After being ridden till thoroughly exhausted, and its lungs bursting for want of breath, it submits to be led back to the coral. Henceforth it is tamed, or, more properly, broken-spirited, and although left free with the domesticated horses, does not seek to escape; for having felt the brand of serfdom, it feels unworthy of liberty. Young horses are generally selected for this mode of breaking, as they give less trouble than those that are older, and, from their making a less determined resistance, are not so subject to injuries that mature into blemishes, or frequently cause unsoundness.

When horses are hit in battle, they stop, tremble in every muscle, and groan deeply, while their eyes show wild astonishment. During the battle of Waterloo, some of the horses, as they lay on the ground, having recovered from the first agony of their wounds, fell to eating the grass about them; thus surrounding themselves with a circle of bare ground, the limited extent of which showed their weakness. Others of these interesting animals were observed quietly grazing in the middle of the field, between the two hostile lines, their riders having been shot off their backs; while the balls that flew over their heads, and the tumult behind and before and around them, caused no interruption to the usual instincts of their nature. It was also observed that when a charge of cavalry went past, near to any of the stray horses already mentioned, they would set off, form themselves in the rear of their mounted companions, and though without riders, gallop strenuously along with the rest, not stopping or flinching when the fatal shock with the enemy took place. At the battle of the Kirk, in 1745, Major Macdonald, having unhorsed an English officer, took possession of his horse, which was very beautiful, and immediately mounted it. When the English

DARING LEAP OF WILD ASSES IN FLIGHT.

cavalry fled, the horse ran away with its captor, notwithstanding all his efforts to restrain him; nor did it stop until it was at the head of the regiment, of which, apparently, its master was the commander. The melancholy and, at the same time, ludicrous figure which Macdonald presented when he thus saw himself the victim of his ambition to possess a fine horse, which ultimately cost him his life upon the scaffold, may be easily conceived.

In a well-known work, which is the highest authority, the following examples of equine intelligence are recorded: It is remarked by those who have much to do with blood-horses, that when at liberty, and seeing two or more people standing conversing together, they will approach, and seem, as it were, to wish to listen to the conversation. The farm-horse will not do this, but he is quite obedient to call, and distinguishes his name readily from that of his companions, and will not stir when desired to stand till his own name is pronounced. He distinguishes the various sorts of work he is put to, and will apply his strength and skill in the best way to effect his purpose, whether in the threshing-mill, the cart or the plough. He soon acquires a perfect sense of his work. A plough-horse will walk very steadily towards a directing pole, and halt when his head has reached it. He seems also to have a sense of time. The horse is capable of distinguishing the tones of the voice, whether spoken in anger or otherwise, and can even distinguish between musical notes. A work-horse has been known to leave off eating and listen attentively, with pricked and moving ears and steady eyes, the instant he heard a low note sounded, and would continue to listen so long as it was sustained; and another was similarly affected by a particular high note. The recognition of the sound of the bugle by a trooper, and the excitement occasioned in the hunter when the pack give tongue, are familiar instances of the power of horses to discriminate between different sounds. They never mistake one call for another.

THE KING OF THE FOREST.

As the horse may be said to stand at the head of domestic animals, so the lion among the wild beasts outranks all others, and holds a place by himself. For courage and commanding presence, he is unrivalled.

If the impression made by the first sight of this animal be retained, it must be confessed that the lion is no usurper of the title "King of the Beasts," which has been awarded him from the most ancient times. He carries his head high, and walks with a slowness which may well pass for dignity; his visage is calm and dignified, and announces a full consciousness of his strength. The bushy and magnificent mane which overshadows his head and neck is an addition which confers on his remarkable appearance an air of grandeur which commands awe.

Some adult lions have attained a length of nearly ten feet, from the tip of the muzzle to the root of the tail; but, generally speaking, they do not exceed six to seven feet. With the exception of the mane and a tuft of hair at the end of the tail, the coat is entirely smooth, and of a nearly uniform tawny color. The female is distinguished by the absence of any mane, and by a smaller head; she is generally, in proportion, about one-fourth less than the male. Buffon has drawn a magnificent portrait of the lion, which will ever remain one of the most beautiful passages in French literature. He attributes to it the good

HIS MAJESTY, THE LION.

qualities of courage, magnanimity, generosity, nobility of character, gratitude for kindness and sensibility. Unfortunately, this elaborate panegyric is fated to give way before observation.

As a rule, the lion does not hunt during the day; not that his eyes are unfitted for diurnal vision, but indolence and prudence keep him at home till evening. When the first shadows of twilight appear, he enters upon his campaign. If there is a pool in the vicinity of his haunt he places himself in ambush on the edge of it, with the hope of securing a victim among the antelopes, gazelles, giraffes, zebras or buffaloes, which

are led thither to slake their thirst. These animals, well aware of this habit of their enemy, will not approach a pond without extreme caution. If one, however, places itself within reach of their terrible foe, its fate is generally sealed. One enormous bound enables the lion to spring on it, and one blow with its paw breaks its back. If the lion misses his aim, he does not endeavor to continue a useless pursuit, well knowing that he cannot compete in speed with the children of the plains. He therefore skulks back into his hiding-place, to lie in ambush until some more fortunate chance presents itself, or complete nightfall comes.

PRODIGIOUS STRENGTH AND AUDACITY.

The lion, however, is not disposed to remain long with an empty stomach. Then it is that he approaches man's habitations, with the hope of surprising the domestic animals. Fences, ten feet in height, form no obstacle to him, for he will bound over such with ease, when, falling into the midst of the herd, he seizes the nearest. The amount of strength which he manifests under circumstances similar to these is really extraordinary. A lion has been known, at the Cape of Good Hope, to carry off a heifer as a cat would a mouse, and, with the burden, leap a wide ditch. It is almost impossible to conceive the muscular force necessary to jump a fence several feet high when carrying a load of several hundredweight.

The audacity of the lion increases in proportion to his need. When he has exhausted all means of procuring subsistence, and when he can no longer put off the cravings of hunger, he sets no limit to his aggressions, and will brave every danger rather than perish by famine. In open day he will then proceed to where herds of oxen and sheep are pastured, entirely disregarding shepherds and dogs. At such times he has been known to carry his rashness so far as to attack a drove of buffaloes, an action which is all the bolder, as a single buffalo, unless it is taken by surprise, is well able to defend itself. One feature, which seems peculiar to the nature of South African lions, is, that they will combine to hunt those animals which, singly, they are unable to encounter with certainty of success. Delegorgue relates that in winter twenty or thirty lions have been seen to assemble during the day-time, and drive their game into narrow passes, in which some of their companions were posted. These are, he says, regular hunts, conducted in due order, but without noise; for the smell of the lion is quite sufficient to drive before it the herbivorous animals. The rhinoceros is sometimes destroyed in this way by associations of lions. There is one important fact which has several times been observed. When the lion is hungry or irritated, he flogs his sides with his tail and shakes his mane. If, therefore, a traveler finds himself unexpectedly in the presence of a

lion, he may thus know the brute's intentions, and can take precautions accordingly. If the tail does not move, the animal may be passed without fear; not only will he not spring upon you, but throwing a stone at him will suffice to drive him away. Under the reverse circumstances, no time must be lost in seeking a place of refuge, unless you are in a position to commence a contest with your arms, and then the more prompt and determined your action the more successful will be the issue, because the lion seldom attacks any living creature when his appetite is satisfied, and because he is content with one victim at a time.

AN ELEGANT RACE OF ANIMALS.

All the members of the deer family are remarkable for the elegance of their shape, the dignity of their attitudes, the grace and vivacity of their movements, the slenderness of their limbs, and the sustained rapidity of their flight. They have a very short tail; moderately sized and pointed ears; their nostrils are generally situated in a muzzle, and their eye is clear and full of gentleness. In most of the species there is, below the internal angle of the eye, a small depression, called a tear-pit, which is nothing but a sort of gland, secreting a peculiar fluid. This gland is not, however, as might be supposed from the name, the place from which the tears proceed.

The reindeer is about the size of the red deer, but it is heavier built. The legs are finely made, although less slender than those of the stag, and are terminated by firm and strong feet. The latter are covered all over with stiff hair, even on the underneath part, a circumstance which singularly facilitates the animal's tread on ice and frozen snow. Its coat is rough, of a greyish-brown color, and is pendent under the throat; in the winter it becomes woolly, and frequently changes color to white. The reindeer is a native of the icy deserts of the Arctic regions, and the most northerly countries in which man has placed his abode. It is a most valuable animal to the people who dwell about the Arctic circle. Without it existence in these high latitudes would scarcely be possible. We can hardly form a just idea of the services which this animal renders, more especially to the Laplanders, for to them it fills the place of horse, ox and sheep; for, when domesticated, it goes in harness like the first, and drags sledges and carriages even with great rapidity. On even ground it can travel twenty miles an hour; but its ordinary pace is from twelve to sixteen miles in that space of time. There is in the palace of the King of Sweden, a picture representing a reindeer which carried an officer charged with urgent despatches a distance of nine hundred and sixty miles in forty-eight hours. At the end of the journey the poor animal is reported to have died.

The mode of harnessing and driving the reindeer is most simple. A

THE REINDEER OF THE ARCTIC REGIONS.

collar of skin is fastened round its neck, and from this a trace hangs down, which, passing under the belly, is fastened into a hole bored in the front of the sledge. The rein consists of a single cord fastened to the root of the animal's antlers, and the driver drops it on the right or left side of the back, according to the side to which he wishes to direct the animal. The vehicle being very light, traveling may be rapidly performed in this equipage, but not without running some risk of breaking your neck; for, to avoid being upset, one must be very skilful in this sort of locomotion. The Laplander is a perfect master of this art. We have not yet mentioned the most important articles this ruminant of the Arctic regions yields to man. The female produces milk superior to that of the cow, and from it butter and cheese of excellent quality are made. Its flesh, which is nutritious and sweet, forms a precious alimentary resource in the Polar regions. Its coat furnishes thick and warm clothing, and its skin is converted into strong and supple leather. The long hairs on the neck of this animal are also used for sewing, while out of its tendons string is manufactured. From the old antlers of the reindeer various utensils are made, such as spoons and knife-handles, and when the horns are young, gelatine is extracted from them by submitting them to a severe course of boiling.

The reindeer is truly an invaluable companion to the people of high latitudes. The poorest Laplander possesses at least several pairs; while the wealthy have immense herds of from four to five hundred, even sometimes of several thousand of these animals. During the day they are taken to graze; and at night they are shut up in sheds, or left out of doors in an inclosure sufficiently high to shelter them from the attacks of wild beasts. These flocks need a great deal of supervision, as the reindeer is somewhat inclined to return to its wild life if granted too much liberty. All the individuals composing these herds are marked with the brand of the proprietor, so that they may be recognized when they stray in the woods, or when the flocks get mixed. The wild reindeer unite in vast herds, which migrate from one climate to another according to the seasons. In winter they come down into the plains or valleys near the sea-coast, and there feed on the lichens which they excavate with their feet from under the snow. In summer they ascend the plateaux to graze on the buds and leaves of mountain shrubs. They are, moreover, induced to select these elevated situations in the warm season to lessen the attacks of the horse and gad-flies, which otherwise would incessantly prey upon them. The latter insects, at the time when these quadrupeds change their coat, deposit their eggs on the surface of the skin; the larvæ, after they are hatched, penetrate under the epidermis, causing acute pain.

In the caves, gravels, and peat-bogs of the British Isles are found not unfrequently the remains of animals which no longer inhabit Western Europe. Some of these animals still exist, as the aurochs, or European bison, in Russian Poland, the reindeer in Lapland, and the musk-ox, now only found existing in extreme northern regions. Others, again, are entirely extinct, as the mammoth and the woolly rhinoceros, both of which were formerly extremely common. To the last category belongs the animal of fine construction which has generally received the name of the Irish elk, owing to the great abundance of specimens found in Ireland. The creature has generally been called an elk, probably because the largest member of the deer family still existing bears that name, but it does not resemble the elk in any way. The true elk is a clumsy-looking beast, with broad antlers furnished with few tines. This animal was intermediate in character between the reindeer and the fallow-deer, but was much larger than either. Its antlers were magnificent, measuring as much as ten feet across from tip to tip, and weighing, with the skull, as much as a hundred pounds in some instances. The antlers have broad palms, and are furnished with a large number of tines. When, however, the palm is well developed, the tines are smaller and the spread of the horns less considerable. The name megaceros, big horn, is well suited to a creature whose head must have formed such a noble object. The height of the animal was about six feet at the shoulders, while the hind-quarters drooped only very little, so that it was somewhat taller than a horse. The most remarkable feature about the skeleton is the development of long processes on the dorsal vertebræ, which were undoubtedly intended as points of attachment for the muscles required to move the heavy head. The female had no horns, as is almost always the case in the deer family. This deer inhabited the outskirts of the forests, and its remains are found almost without exception in the marl at the outside of peat-bogs. In such abundance do they occur, that in one small bog near Lough Gur, in the county of Limerick, upwards of seventy heads were dug up in the autumn of 1864, in addition to a very large number obtained in previous years.

EARLY ACCOUNTS OF THE HUNTER'S SPORT.

In old Irish manuscripts there are frequent allusions to field sports and in one of them particularly the descriptions of deer and deer hunts are not uncommon. Most of these would suit red-deer as well as the animal which we are now discussing; however, one of them seems to refer to a deer with very large antlers, and to show that it was existing in the time of St. Patrick. The Irish name for the great deer was the Ox of the Deluge.

There is another remarkable animal that is common to the Arctic

world. The musk ox is much smaller than the common ox, and has somewhat the appearance of an enormous sheep. Its forehead is arched; its mouth small; its muzzle completely covered with hair; and its horns, which are very large, are closely united at the base, and bending downwards over the sides of its head, suddenly turn backwards and upwards at the tips. Its long and abundant coat is of a dark brown color. It exhales a strong odor of musk, which even impregnates the flesh. This animal inhabits North America below the Polar circle, and lives in families of from twenty to a hundred individuals, among which there are seldom more than two or three males. In the month of August the latter become so jealous that they fight even to the very death. Notwithstanding its apparent heaviness, the musk ox climbs over rocks almost as nimbly as a goat, and its speed

EXCITING ENCOUNTER WITH THE MUSK OX.

across the rocky, rough, barren grounds, its principal habitat, for an animal so clumsy, is truly astonishing. It makes a spirited defence when assailed, and will toss the dogs that worry it in the air, as well as the hunter, if he makes the mistake of coming too near. Its long, thick, brown or black hair hanging down below the middle of the leg, and covering on all parts of the animal a fine kind of soft ash-colored wool, which is of the finest description, and capable of forming the most beautiful fabrics manufactured, enables it to remain even during the winter beyond seventy degrees of northern latitude. In spring it wanders over the ice as far as Melville Island, or even Smith's Sound. It is exclusively confined to the New World now, though that it was common at one time in Siberia is attested by the great number of fossil remains of the animal still to be found there. Its legs are short,

but it runs with much speed and climbs lofty precipices like the Rocky Mountain goat. The animals go in herds of twenty or thirty, but are so scarce as to be seldom met with.

Somewhat like the musk ox in appearance is the yak which makes its home in Thibet. The yak likes to live on the cold snowy mountains. It has a clothing of soft curly hair almost like fur. Its tail sweeps the ground, and is of bright-colored hair. It has horns like a cow, and there is a hump between the shoulders. Its legs are very short; and sometimes its long hair will trail on the ground, and give it rather an awkward look. It is not fierce, though it does not like to be meddled with. The people of Thibet think the yak one of their greatest blessings. The milk of the cow is very thick and rich, and there is a great quantity of it. It makes excellent butter.

THE LONG-HAIRED YAK.

The mother yak is so fond of her young one, that when it is taken from her, she will not give any milk. The farmer's wife in Thibet knows what to do. The young yak has been killed; but she brings its foot, and lays it down before the mother for her to lick. The yak seems quite contented; and as she goes on licking the foot, she gives her milk as usual. The soft hair of the yak makes clothing when woven into a strong cloth. The shepherds who pasture their flocks in these cold regions wear a loose garment made of the hide of the yak. It hangs down to the knees, and is very warm and comfortable. At night they lie down upon it, and it serves them for a bed. The long hair is made into a tent-cloth, and also into ropes. The long, bright-colored tail is used for an ornament. Indeed, the whole wealth of some of the Tartar tribes in Thibet consists in this animal. The yak goes up and down the mountains, and does not often stumble. It carries burdens on its back; for the Tartars use it instead of a horse or a camel.

The goat is likewise remarkable for the agility it shows in climbing

steep and difficult places, being made apparently to inhabit rocky regions and prove useful to men who make their abode in such localities. Dr. Clarke relates that when he was traveling from Jerusalem to Bethlehem, his party fell in with an Arab who had a goat, which he led about the country for exhibition. He had taught this animal, while he accompanied its movements with a song, to mount upon little cylindrical blocks of woods, placed successively one above the other, and in shape resembling the dice boxes of a backgammon table. In this manner the goat stood first upon the top of one cylinder, then upon the top of two, and afterwards of three, four, five and six, until it remained balanced upon the top of them all, elevated several feet from the ground, and with its four feet collected on a single point, without

THE AGILE SYRIAN GOAT.

throwing down the disjointed fabric upon which it stood. Doctor Clarke adds, that this feat is very ancient. Nothing can show more strikingly the tenacious footing possessed by this quadruped upon the jutting points and crags of rocks; and the circumstance of its ability to remain thus poised may render this exhibition less surprising. It is seen frequently in mountainous countries, standing securely, though with hardly any place for its feet, upon the sides and by the brink of the most tremendous precipices. The diameter of the upper cylinder upon which its feet ultimately remained until the Arab had ended his ditty was only two inches, and the length of each cylinder was six inches. The most curious part of the performance occurred afterwards; for the Arab, to convince Doctor Clarke's party of the goat's attention to his tune, interrupted the music. As often as he did this the

goat tottered, appeared uneasy, and upon his master becoming suddenly silent in the middle of the song, fell to the ground.

For extraordinary muscular activity and ability to overcome apparent defects of organization, the kangaroo may be cited as a conspicuous example. The most prominent characteristic of the kangaroos is the relative disproportion of their anterior and posterior limbs. Whilst the former are short and weak, the latter are singularly long, thick, and strong. Thence the name macropus ("large foot"), which is given to this section of the animal kingdom. The tail is long and powerful, and constitutes a sort of fifth member, destined to facilitate in the kangaroos that mode of progression which is peculiar to them. There

THE MARVELOUS KANGAROO AND HER YOUNG.

is a great disproportion between the anterior and posterior limbs, also the two bones called marsupial. Very curiously, however, in one of the arboreal kangaroos of New Guinea, the anterior limbs are even larger than the posterior; and in another species inhabiting the same country, the fore and hind limbs are about equal; while in a third New Guinea species the fore limbs are unusually large for an animal of this group. It is adapted to the locality it inhabits.

According to circumstances these animals walk or leap, and their tail plays a great part in either case. In walking they first place their four feet on the ground; then, leaning on those which are in front and on their tail, stretched out like a rigid bar, they raise their hinder parts, bringing up in the same time their two posterior close to their two

anterior legs, and moving the latter forward to begin again the same manœuvre, and so on repeatedly. One can understand that they cannot move very quickly in this way, and so they have recourse to another expedient when they are pursued, or when they want to leap over any obstacle they find in their road. The fore legs then remain unemployed; they hang idly along the body. Squatting on its hind legs, the tail stiff and leaning on the ground like a prop, as it does when the animal is walking, the kangaroo bounds, as if it were propelled forwards by a spring, and alights a little further on, where it begins the same exercise over again, and thus on indefinitely, till it chooses to stop. The larger species of kangaroo clear as much as thirty feet in a single bound, and can jump ten feet in height. Nothing is more curious than to see them thus traversing space with almost the rapidity of arrows, and, like the giants we read of in mythology, receiving fresh vigor every time they touch the ground.

To complete the picture of the giant kangaroo, we must add that its muzzle is long and slender; its ears large and straight; its body thin in front, very massive, on the contrary, behind, that it possesses only four toes on the posterior extremities, and that one of these toes is provided with a most tremendous nail; that its coat is composed of silky hair on the head, the limbs, and the tail, and of woolly hair on the rest of the body; lastly, that in its diet it is essentially herbivorous. The female is provided with a curious pocket below the breast for carrying her young, one of those suitable provisions which show the work of design in creation, and of which there are so many.

The animal is not a native of our own country, although it easily becomes acclimated, and flourishes in the temperate zone. We have, however, in our Great West a variety of animals, all of them wonderful in construction, nature and habits. They have a wide territory for their home, yet the steady advance of civilization is crowding them farther and farther away, and must ultimately sweep them from the plains. The buffalo, the fleet deer, the prowling wolf, the cunning fox, the prairie-dog, the various creatures that crawl or fly—all these abound in our own frontiers, where, as elsewhere, exploration has brought astonishing marvels to view.

We must go abroad, however, for that wonder of the desert—that patient, burden-bearing, long-enduring, strange-looking animal—the camel. The camels have a small and strongly-arched head. Their ears are slightly developed, still their sense of hearing is excellent. Their eyes, which have oblong and horizontal pupils, are projecting and gentle in expression, and are protected by a double eyelid. Their power of sight is very great. Their nostrils are situated at some dis-

THE ANIMAL WONDERS OF THE GREAT WEST.

tance from the extremity of the upper lip, and, externally, appear only as two simple slits in the skin, which the animal can open or shut at will. No trace is found round the nostrils of the camel, of the glandular body which forms the muzzle in other ruminants, and attains such development in the ox. Their upper lid is split down the centre, and the two halves are susceptible of various and separate movements, constituting a very delicate organ of feeling. They are also possessed of an extremely acute sense of smell. This remarkable head is carried

THE WONDERFUL BACTRIAN CAMEL.

with a certain degree of nobility and dignity on a somewhat long neck, which, when the animal moves slowly, describes a graceful arched curve.

Their peculiar body, made more remarkable by the one or two humps on its back, is supported on four long legs, which appear slender in comparison with the mass they bear. In the Bactrian Camel the color of the coat is chestnut-brown, more or less dark. The hair grows to a considerable length, and becomes rather curly on the humps and about the neck. Below the neck it forms a fringe, which descends over the

fore-legs. The dromedary, which is less massive in form and smaller in size than the camel, has a coat of brownish-gray, more or less dark; in some instances it is nearly bay. Its hair is soft, woolly and moderately long, more especially about its hump and neck. There are, however, peculiarities of coat characteristic of the different races. We must not omit to mention the callosities which camels have on their breasts, knees and insteps, as well as on their heels. Their feet are bifurcated. The two toes on each foot are not enveloped in horn, and have only on the last joint a somewhat short and hooked nail. A hard and callous sole covers the bottom of the toes, a characteristic which enables them to walk with ease on loose sand, where the elephant would be useless and the horse would soon exhaust its strength. The Bactrian camel is a native of ancient Bactria, now the country of the Usbecks. It principally lives in Asia, where it has been used from antiquity, for domestic and military service. In Africa, where it is acclimatized, it has doubtless existed since the time of the conquest of that country by the Arabs. The dromedary is distributed all over a great part of Northern Africa, and the major portion of Asia. It seems originally to have been a native of Arabia.

Buffon has said that gold and silk are not the real riches of the East, but that the camel is its chief treasure. In fact, this animal feeds the inhabitants of these countries, both with its milk and flesh, and furnishes clothes for them, fabricated from its long and soft hair. For centuries, sal-ammoniac, so useful to the manufacturer, was solely obtained from it. But it is chiefly as a means of conveyance and as a beast of burden that it renders the most important service to man. Without it those nations which are separated from one another by vast stretches of desert sand could not trade with each other. Without it the Arab could not inhabit those arid countries in which he dwells. With it, this "ship of the desert," as the eastern nations have called it in their figurative and symbolical language, life is possible even in such places as Buffon has called "the blank spots in nature."

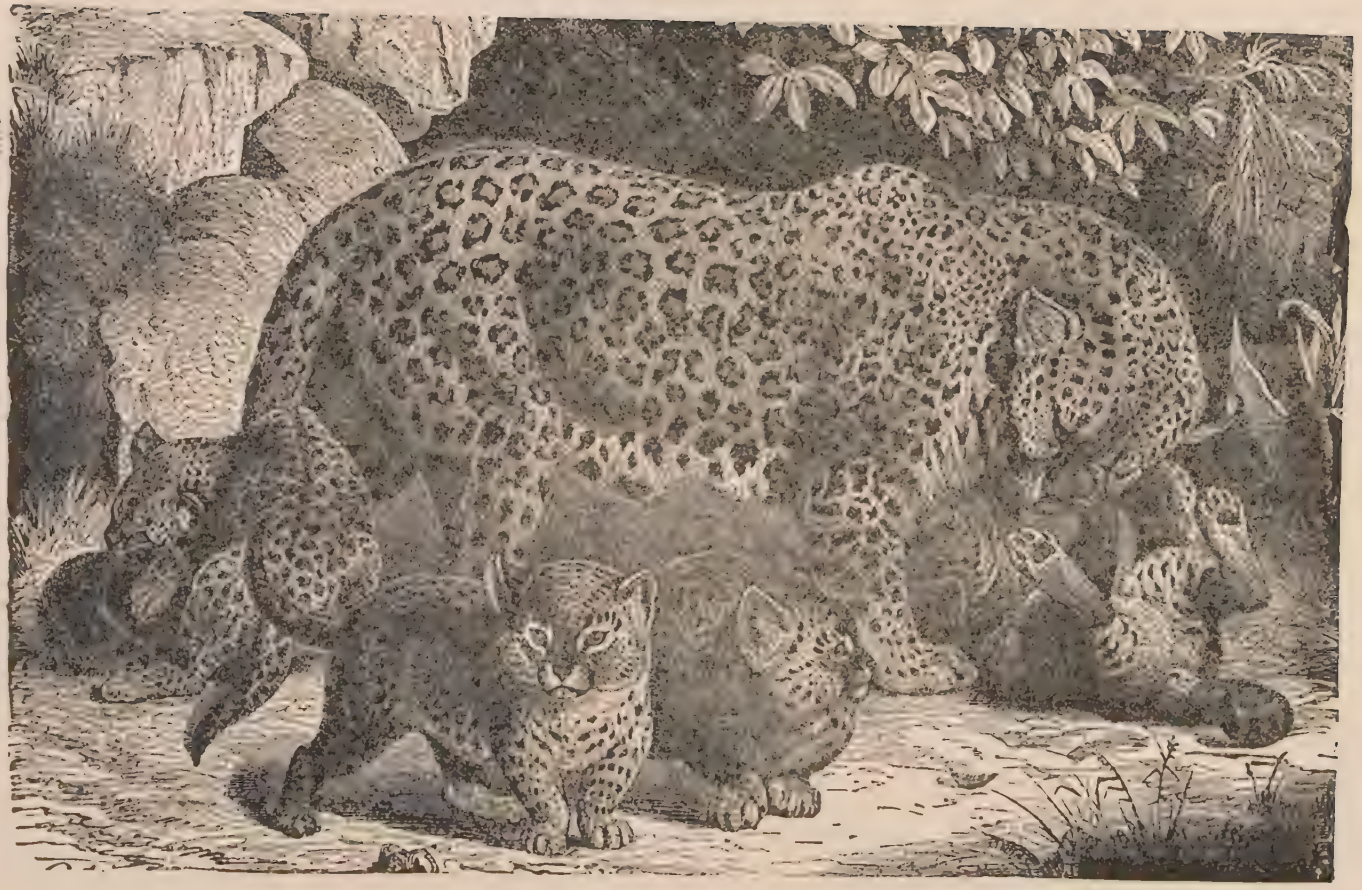
From time immemorial the camel has been the only means of bearing commodities across the desert. By means of this patient and strong animal merchandise finds its way from the remote countries of Asia as far as the eastern confines of Europe. The rich products of Arabia, in ages past, were brought to Phœnicia on the backs of camels; and in our time, in the same way, merchandise is borne to Alexandria, from whence it is distributed over the European continent. The better to fit the camel for its arduous life, the Arab trains it to do without sleep, and to suffer all the extremes of hunger, thirst and heat. A few days after its birth its legs are bent under its stomach, and it is compelled to

remain crouched upon the ground, laden with a suitable weight, which is gradually increased with its age. As it arrives at maturity, its food is restricted, and given at longer intervals; it is also practised in running and enduring severe exercise. Yet it knows when it is abused, and, sometimes, like the elephant, it retaliates. A valuable camel, working in an oil mill in Africa, was severely beaten by its driver. Perceiving that the camel had treasured up the injury, and was only waiting a favorable opportunity for revenge, he kept a strict watch upon the animal. Time passed away; the camel, perceiving that it was watched, was quiet and obedient, and the driver began to think that the beating was forgotten, when one night, after the lapse of several months, the man was sleeping on a raised platform in the mill, whilst, as is customary, the camel was stabled in a corner. Happening to awake, the driver observed by the bright moonlight that, when all was quiet, the animal looked cautiously around, rose softly, and stealing towards a spot where a bundle of clothes, thrown carelessly on the ground, resembled a sleeping figure, cast itself with violence upon them, rolling with all its weight, and tearing them most viciously with its teeth. Satisfied that its revenge was complete, the camel was returning to its corner, when the driver sat up and spoke. At the sound of his voice, and perceiving the mistake it had made, the animal was so mortified at the failure and discovery of its scheme, that it dashed its head against the wall.

A MUCH-ABUSED AND RIDICULED ANIMAL.

Quite as wonderful as the camel is the plain and homely ass, whether we consider its burden-bearing qualities or its disposition. Why, says Buffon, very justly, is there so much contempt for an animal so good, so patient, so abstemious and so useful? Can it be that men despise, even in animals, those who serve them too well and at too little expense? We confer on the horse a degree of education; he is cared for, he is trained and he is exercised, whilst the ass is handed over to the mercy of the lowest servant, or to the malice of children, and, so far from improving by education, he must almost always be the worse for it; if he did not possess a large supply of good qualities he would, in fact, lose all in consequence of the treatment which he receives. He is too frequently the plaything, the butt and the drudge of his owner, who drives him, beats him, overloads him and tires him out, without care and without mercy. There seems to be no attention paid to the fact that the ass would be the best and most useful of animals, if there had been no such animal in the world as the horse.

While the horse is full of pride, impetuosity and ardor, the ass is mild, humble and patient, and bears with resignation the most cruel treatment. Most abstemious in its habits, it is content with the coarsest



GREAT AFRICAN LEOPARD AND FAMILY.

herbage, which other beasts will not touch, even such as thistles and weeds. A small quantity of water is sufficient for it, but this it requires pure and clear. It will not, like the horse, wallow in mud or water; and as its master too often forgets to groom it, it performs this duty by rolling itself on the turf or the heather when opportunity offers. It has sharp sight, an excellent sense of smell and an ear of keen acuteness. If it is laden too heavily it remonstrates by drooping its head and lowering its ears. When it is teased, it opens its mouth and draws back its lips in a disagreeable manner, giving it a mocking and derisive air. The ass walks, trots and gallops like the horse, but all its movements are shorter and slower. Whatever pace it employs, if too hardly pressed, it soon becomes tired; if not hurried, it is most enduring. It sleeps less than the horse, and never lies down for this purpose except when worn out with fatigue. It never utters its long and discordant cry, which passes in inharmonious succession from sharp to flat and from flat to sharp, except when hungry, or expressing amorous feelings.

MORE THAN A MATCH FOR WOLVES.

The ass carries the heaviest weight in proportion to its size of all beasts of burden; it costs little or nothing to keep, and requires, so to speak, no care; it is a most useful auxiliary to the poor man, more especially in rugged mountainous countries, where its sureness of foot enables it to go where horses could not fail to meet with accidents. It is, therefore, the horse of those of small means; the abstemious and devoted helper of the poor. It suffers with resignation under the tyranny of its oppressors. In energy, in nervous power, and in temperament, the ass even surpasses the horse. It is also superior to the latter in docility, abstemiousness, and capacity to endure fatigue. The wild ass, in its shape and proportions, takes the middle place between the horse and the ass. It resembles a mule, but its legs are more slender, and its carriage is lighter. The general color is dun, the main and dorsal stripe black, and the tail is terminated by a black tuft. This animal inhabits the sandy deserts of Asia, especially those of Mongolia, or the plains north of the Himalaya. In their periodical migrations they come down as far as the Persian Gulf and Hindoostan. To the north, they do not go beyond the forty-fifth degree of latitude. They live together in innumerable droves, and travel under the guidance of a leader, whom they obey with intelligent submission. If they chance to be attacked by wolves they range themselves in a circle, placing the weak and younger members in the centre, when they defend themselves so courageously with their fore-feet and teeth that they almost invariably come off victorious. The Tartars capture them to get possession of their skins; they also eat their flesh, which is considered

excellent. The wild ass is endowed with a sure foot and great swiftness, but it is difficult to tame. In order to capture them, snares and nets made of cord are placed around the places where they are in the habit of coming to drink. Larger than the domestic animal, the wild ass has a narrower chest, lighter body, and shorter ears. Its legs are also long, the forehead arched, the head lean, which it carries erect, like the horse. The top of the head, the sides of the neck, the flanks, and the croup are of a dun color, with stripes of dirty white; the mane is black; there is a coffee-colored line along the back, which widens on the croup, and, in the males only, is crossed by another band on the shoulders. In the books of Moses the wild ass is mentioned, so that it was well-known to the ancients. It also figured in the festivals which the Roman emperors gave to the people to make them forget the loss of their liberty and their departed grandeur.

THE SINGULAR AYE-AYE.

A remarkable specimen of animal life is found in one of the tropical islands. The aye-aye is a native of Madagascar, which Sonnerat discovered in that island towards the end of the eighteenth century. This singular animal, which is very rare, was not even known at that period to the people of Madagascar, and the name of aye-aye given to it by Sonnerat was due to the exclamation of the natives of that island when this traveler showed it to them for the first time. At first sight the aye-aye shows some striking points of resemblance to the squirrels: it has their general form, the long bushy tail, and especially their dentition. It has, in fact, no canine teeth, but possesses in front of its jaws, a pair of strong incisors, isolated from the molars by a vacant space similar to the gap occurring in the squirrels and other animals belonging to the order of rodentia. But, on the other hand, the large size and rounded form of its head, indicative of a voluminous brain; the conformation of its limbs; the length of the digits, and the opposable thumb in the posterior members; the complete state of the bony circle of the orbit; the exist-

ence of only two mammæ in the female; are characteristics which assimilate the aye-aye to the lemurs. The habits of the aye-aye are very little known; Sonnerat said that it used its long front toes to dig into the bark of trees, where it found the insects on which it fed. Nevertheless, some particularities in its dentition lead to the belief that it also eats fruit. Sonnerat kept a pair of aye-ayes alive for two months. I fed them, he says, on boiled rice, and to eat this they used the slender toes of their fore-feet, as the Chinese use their chopsticks. They were drowsy-looking, and sleep with their heads placed between their fore-legs; it was only after shaking them several times that they waked up.

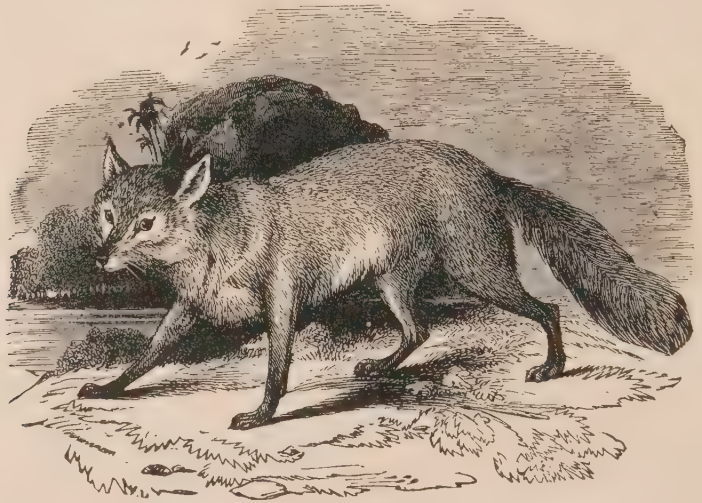
AN EAVESDROPPER WITH BIG EARS.

What a strange physiognomy is given to the skull of the little rarity by the enormous, curved, chisel-shaped pair of teeth at the fore part of the upper and under jaws! What can be the meaning of that long-shrivelled middle finger on each of the hands? It looks like a bent probe, only there is a hook at the end. This quadruped is stated to sleep during the heat and glare of the tropical day, and to move about chiefly at night. The wide openings of the eye-lids, and the whole construction of the eye, are arrangements for admitting to the retina, and absorbing the utmost amount of the light which may pervade the forest at sunset, dawn or moonlight. Thus the aye-aye is able to guide itself among the branches in quest of its hidden food. To detect this, however, another sense had need to be developed in great perfection. The large ears are directed to catch and concentrate, and the large acoustic nerve, seemed designed to appreciate any feeble vibration that might reach the tympanum from the recess in the hard timber through which the wood-boring insect on which it feeds may be tunneling its way by repeated scoopings and scrapings of its hard little jaws.

No less singular than the aye-aye is the four-footed animal that flies, a fox endowed with wings. The flying fox is a very curious inhabitant of the forests near Moreton Bay, in East Australia. It lives in flocks, and moves generally towards the dusk of the evening, and the noise produced by the heavy flapping of the so-called wings is very singular. The flocks like quiet places where there are large Araucarian pine trees, with an underwood of scrub and creepers. The foxes hang in vast numbers from the horizontal branches of the pine trees. When there is a clear space amongst the trees, an enormous number of the animals may be seen, and their noise can be heard; for directly they see anything unusual, they utter a short bark, something like the sound made by young rooks. Often every branch is crowded, and the flying foxes are seen either flapping their wings, and holding on with their hind feet, and with their head downwards, or snarling and fighting for places. Suddenly the whole

take to flight, and flap their furry, wing-like sides, and wheel around like heavy birds. Many fly with their young holding on to them. The creature is not a true fox, and there is a fold of skin which reaches from the fore to the hind legs. This is called the wing, and it enables the pteropus, as the animal is called, to float and turn in the air.

The ordinary fox, as he is known among us, has always been notorious for his cunning. He has a way of looking out for himself, and is not wanting in shrewdness. Many facts showing this are on record. The proverbial cunning of a fox is well illustrated in the following anecdote: I have been assured by a person not given at all to exaggerate, nor easily deceived, that he once witnessed the following trick. Very early one morning he saw a fox eyeing most wistfully a number of wild ducks feeding in the rushy end of a highland lake. After due



AN ANIMAL NOT TO BE TRUSTED.

consideration, the fox, going to windward of the ducks, put afloat in the lake several bunches of dead rushes or grass, which floated down amongst the ducks without causing the least alarm. After watching the effects of his preliminary fleet for a short time, the fox, taking a good-sized mouthful of grass in his jaws, launched himself into the water as quietly as possible, having nothing but the tips of his ears and nose above water. In this way he drifted down among the ducks, and made booty of a fine mallard. Though this story seems extraordinary, it must be remembered that the fox manages to capture wild ducks, wood-pigeons, hares and numberless other animals, sufficient to keep himself and family; and it is self-evident that in doing so he must practise many a trick and manœuvre that would seem most improbable if re-

lated, and quite beyond the instinct of animals. Another anecdote, quite as striking as an illustration of the fox's wonderful sagacity, appeared, a few years back, in a Preston paper. A farmer of that neighborhood had discovered that a fox came along a beam in the night to seize his poultry. He accordingly sawed the end of the beam nearly through, and in the night the fox fell into a place whence he could not escape. On going to him in the morning, the farmer found him stiff and, as he thought, lifeless. Taking him out of the building, he threw him on the ground, but in a short time Reynard opened his eyes, and, seeing that all was safe and clear, galloped away to the mountains, showing more cunning than the man who ensnared him.

Other animals are sagacious and seem to know how to reason, but are not conspicuous for cunning. At certain seasons of the year the streams in some parts of North America, not far from the coast, are filled with fish to a surprising extent. A real Newfoundland dog, belonging to a farmer who lived near one of those streams, used to keep the house well supplied with fish. He thus managed it: he was perfectly black, with the exception of a white fore-foot, and for hours together he would stand almost immovable on a small rock which projected into the stream, keeping his white foot hanging over the ledge as a lure to the fish. He remained so stationary that it acted as a very attractive lure; and whenever curiosity or hunger tempted any unwary fish to approach too close, the dog plunged in, seized his victim, and carried him off to the foot of a neighboring tree; and on a successful day he would catch a great number.

The jerboas are pretty little animals, with a large head, prominent eyes and wide ears. Their front legs are very short, with only four toes at the extremities, fitted for digging. The hind legs are five or six times longer than the front ones, and are terminated by three or five toes, according to the species. This kind of organization recalls to mind that of the jerboa rats; but their long legs make them much more striking. The tail is long and covered with short hair, and terminated by a tuft; the coat is soft and thick. The jerboa inhabits the vast solitudes of Africa, and the steppes of Tartary and Russia. They dig out burrows, in which they pass the day, sleeping on a bed of grass and moss. But in the evening they seek their food, which consists of roots and seeds. They make use of their fore paws to convey what they eat to their mouths, in this respect resembling the sprightly squirrel.

Under ordinary circumstances, when nothing occurs to hurry or excite them, the jerboas walk on all fours; but if, from the scarcity of sustenance, or the necessity of escaping from danger, they are compelled to go a considerable distance in a short space of time, they use

their hind legs only, moving forward in leaps, like the jerboa rats; but the span of their bounds is of much greater extent, reaching sometimes to three yards. The way in which these springs are made is very curious. The animal first crouches down, at the same time stretching out and stiffening its tail, so as to make another bearing-point on the ground; then, suddenly, it bounds forward, as if forced by a spring. The same manœuvre is repeated after an imperceptible interval of time. It is said that the jerboa can compete in speed with a fast horse. The ancients, looking at this peculiar mode of progression, were led to think that the fore-legs of these rodents were absolutely unfitted for walking, and for this reason gave them the name of dipus, which signifies two-footed. Jerboas are difficult to tame; they can, however, be kept in strong cages.

THE FAMOUS JERBOA.

Very strange are proboscis monkeys, so named because of their nose, which surpasses in length that of mankind. This is a peculiarity which distinguishes them from all other known monkeys. They are also recognized by their hair, which is more developed beneath the chin and around the neck than on the other parts of the body. These animals are the largest of their species, measuring nearly four feet when standing upright. They are also the most ferocious and least susceptible of training. They inhabit the island of Borneo, and are found in numerous troops among the woods in the neighborhood of streams. It is rare to see them on the ground, nearly the whole of their lives being passed on trees. Up to the present time only one long-nosed species has been discovered.

The natives of Borneo pretend that the proboscis monkey, or, as sometimes called, Kahau, is a man who has retired to the woods to avoid paying taxes, and they entertain the greatest respect for a being who has found such ready means for evading the responsibilities of society, and escaping the clutches of the law.

Pliny alludes to the fact that white monkeys are occasionally found in India; but it has generally been supposed that the specimens seen were albinos. Sir Emerson Tennent had one brought to him in Ceylon, which certainly could not have been an albino, as it had a black face and black eyes, all the rest of the body being white. He was told by the natives that this kind was not uncommon. Others are occasionally found entirely white, face and all. The Rev. R. Spence Hardy mentions in his work on Eastern Monachism, that on the occasion of his visit to the great temple of Dambool, he met with a troop of white monkeys on the rock where the temple is situated. There can be no doubt of the fact, therefore, that white monkeys are really one of the varieties of the race.

THE STRANGE PROBOSCIS MONKEY.

The guenons are slender monkeys, which have the cranium depressed, and show no forehead—at least at an adult period of life; they have large paws, marked callosities, long, sharp canine teeth, well-formed extremities for prehension, a long elevated tail and a thick and more or less speckled coat. Naturalists usually designate them by the name of Cercopitheci, which means tailed monkeys. The genus comprises about thirty species. These animals live in troops in the forests; they are constantly moving about from tree to tree, and with an extraordinary facility execute the most wonderful capers. In each troop there is a sentry intrusted to watch over the general safety. On the appearance of an enemy, this vedette gives a particular cry, and all the band, collecting in the highest places they can find, at once prepare to repel the intruder. Fruits and branches are then hurled down at the aggressor, who, disarmed and helpless against this aerial horde, is soon compelled to take to flight. The negroes find this kind of skirmishes but little to their taste, and, therefore, rarely trust themselves in those parts of the forests where the guenons have established their domicile. The largest quadrupeds, not even excepting the elephant, are not exempted from

these attacks, and find it advisable to evade by flight the disagreeable, if not dangerous, consequences of such conflicts. There are only two beings capable of contending successfully with them; these are man, with his bow or firearm, and the serpent, which creeps in the darkness to the highest branches of the trees, and in this way contrives to circumvent and seize these dwellers of the forests.

The food of the monkeys is varied; they chiefly live on roots, leaves and fruits. They also eat the eggs of birds, insects, sometimes even mollusks, and they are particularly partial to honey. They devastate gardens and plantations, and appear impelled to commit these acts of brigandage as much from an instinct for thieving and pillage as from the demands of hunger, for they destroy and damage all that they cannot carry off. They go about the destruction of gardens in the same manner as the magots; that is to say, they charge some one of their number to collect the spoil, which is quickly passed from hand to hand. The surprise of the planter who finds himself face to face with this pillaging tribe may be left to the imagination.

They have a singular aptitude in passing from gaiety, which is otherwise their usual state, to melancholy, from melancholy to joy, and from joy to anger, in a few seconds, and from the slightest causes. We see them ardently desirous of obtaining a certain object, testifying the liveliest pleasure if allowed to possess it, and almost immediately after throwing it away with indifference, or breaking it in a fit of rage. We also see them delighting in the society of another animal, evincing in their own way the most tender regard for it, and then suddenly becoming irritated, pursuing it with hoarse cries, and biting it as if it were an enemy; immediately peace is made, and the caresses recommence and continue, until a new caprice brings about the same results.

Perhaps no more singular animal in appearance was ever created than the mandrill. Baboons almost exclusively inhabit Africa, a single species only being found in Asia. They live either in forests, or low mountainous rocky localities, and subsist on fruits and insects. In captivity they are almost omnivorous The mandrill is characterized in the first place by a very short tail, and in the second by deep wrinkles on each side of the nose, and which are more or less brilliantly colored. Indeed, the mandrill is one of the cynocephali whose colors are the brightest. It has the face streaked with brilliant red, blue, and black bands. The upper part of the thigh is of a bright red, mixed with blue, and very peculiar in appearance. It is remarkable that these diverse colorations are not permanent, but disappear when the animal is in bad health.

The mandrill, when old, is vindictive and malicious. Even when

taken young, and supposed to be tame, it should never be trusted. Captivity does not in any way tone down the violence of its character. Yet among these animals there are some which preserve their docility for a long time. We have an instance of this in the one exhibited in London, which, in consequence of its intelligence, acquired considerable reputation. This monkey, named Happy Jerry, seated himself with an air of hauteur in a carriage, drank porter out of a pewter pot, and smoked a pipe with all becoming gravity. The baboon was known to the ancient Egyptians, on whose monuments it often appears. It symbolized the god Thoth, the inventor of the alphabet, and for this reason it was held in great veneration. Numerous mummies of this animal have been found in Egyptian burial-places. At the present time they make a less noble figure in society. The Orientals train it to perform various tricks, and exhibit it in public. It is a native of Abyssinia, Sennaur, and Arabia.

THE MARVELOUS MANDRILL.

The monkey tribes, although bearing a form and resemblance suggestive of man, do not possess the amount of intelligence, or sagacity, which belongs to several other species of animals. The elephant is not only a marvel in size and construction, but also in certain qualities of a higher order, far superior to every other animal.

The enormous physical strength of the elephant is scarcely so wonderful as the extreme sagacity with which he often exercises it. At Malire, on the coast of Malabar, M. Toreen relates that he had the opportunity of witnessing a remarkable instance of this. An elephant had been hired out for a certain sum per day, and its employment was to carry with its trunk timber for a building out of a river. This it did very dextrously under the command of a boy, laying the pieces one upon another in such exact order that a man could not have done better. A traveler saw a ship in course of construction at Goa, and at a short distance from it a number of heavy logs of wood. The men engaged in the work fastened a rope to the end of the beam that

required moving, and handed the other end of the rope to an elephant, who twisted it round his trunk and dragged the timber to the ship without any conductor. One of the elephants sometimes drew beams so large that twenty men could not have moved them. What is still more surprising, when other pieces of timber lay in his way, the elephant had the sense to lift up the end of his own beam, and run it over them with the intelligence of a human being.

Some years ago two elephants, a male and female, were taken from the menagarie of the Prince of Orange, at the Hague, to Paris, to a place suitably prepared for their reception. The inclosure, formed of strong and thick beams, was in two divisions or apartments, separated by a gate. The male elephant entered first, and looked suspiciously about him. He then proceeded to examine every bar with his trunk, as if trying their solidity. They were held together by large screw-bolts, the heads of which were outside; these the elephant found out, and tried to turn the screws, but was not able. When he came to the gate between the two apartments, he soon discovered that it was only secured by an iron bar which rose perpendicularly. He raised it with his trunk, pushed up the door, and entered into the second apartment, where he found a breakfast had been prepared for him, with which he made himself quite comfortable.

From the instances of sagacity and strength already related, it may be inferred that the elephant can be trained to perform almost any suitable task in the absence of his master. M. d'Obsonville relates that he saw two elephants engaged by themselves in breaking down a wall in accordance with orders previously received, the reward for which they well knew was to be a dessert of fruits and brandy. Their trunks were protected from injury by leather, and they had the sagacity to combine their efforts. Doubling up their trunks, they thrust against the strongest part of the wall, carefully observing and following with their eyes what effect they produced upon its equilibrium. At last, when it was sufficiently loosened, they made one violent push together, and, on their suddenly drawing back, that they might not be hurt, the wall came tumbling to the ground, but they were out of danger.

THE WONDERFUL WHITE ELEPHANT.

Among the animals which in various countries have been the objects of superstitious veneration, few have ever received the attention accorded in the kingdoms of Siam and Ava to a white elephant. Such an animal, when he makes his appearance in the forest, is regarded as sacred; no effort is spared to capture him, and when caught he is housed in regal state, a long train of attendants being allotted to his service. "King of the White Elephants" is considered one of the

proudest titles of which the monarchs of these countries can boast; and fierce wars have been waged for the possession of one or more of the beasts. They are looked upon as the symbol of all kingly authority, and to be without one would be taken as an indication of the displeasure of heaven, and a certain omen of disaster.

In Ava, especially, the white elephant is held in the highest honor. He bears the title of "lord," and is ranked next to the king and before the queen in dignity. His house is sumptuously decorated, and he has a minister of high rank to superintend his household. When there are two or more of these animals in the possession of the king at the same time, all are treated with similar care.

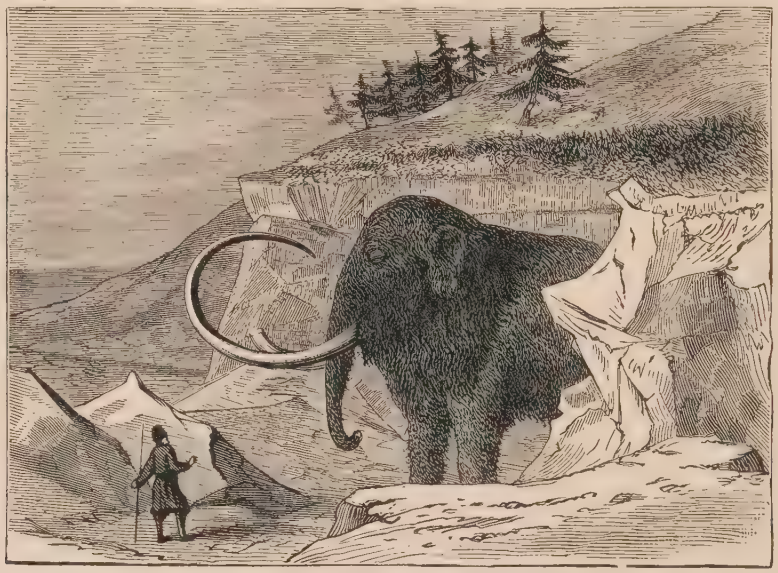
Their food is given them in vessels of silver gilt. Every day when they go to the river to wash, each goes under a canopy of cloth of gold, or silk, carried by six or eight men; and eight or ten men go before each, playing on drums and shawms, and other instruments. When each has washed, and is come out of the river, he has a gentleman to wash his feet in a silver basin, which office is appointed by the king. There is no account made of the black elephants, be they ever so great; and some of them are wonderfully large and handsome.

For the maintenance of these elephants, one of the finest provinces in the kingdom was allotted by a recent sovereign of Burmah. As, professedly, a mark of high esteem, the monarch has occasionally entrusted the keeping of a white elephant to one of his nobility; but the expense involved in the charge has been, now and then, so great as to ruin the unlucky recipient of this doubtful honor. Hence, "to have a white elephant to keep" has become a common saying when a person has an expensive and unprofitable dignity or undertaking upon his shoulders.

The mammoth, or hairy elephant, is extinct, and a live one has never been seen since men have known how to read and write; but its bones are found over the whole of Europe, Northern Asia, and North America. The elephants now living are the African with large, and the Indian with small ears; these are both dwellers in hot climates, and would die if left to themselves even in the temperate countries of Europe. But the hairy mammoth was an elephant which lived in cold and temperate climates, and it is a most interesting creature, because its teeth, tusks, and bones, which are by no means uncommon in old bogs, gravel-pits and brick-fields, are often associated with the weapons of the first men who traveled from the East to colonize Europe, then a country full of wild beasts. It is supposed that the mammoth lived amongst the forests of the great plain of Siberia, and that it was often overtaken by floods and drowned. The carcases would float until

covered with ice, gravel, and sand, and would generally decompose, and only the tusks and bones would be left. Thousands of mammoth tusks had been found in Siberia before the chief discovered the whole animal, and it is believed that there are as many more mammoths still covered up in Siberian gravel and mud as there are living elephants in India and Africa.

Doubtless the mammoth was larger than the elephant, but it fell beneath the constant attacks of savage men; and, moreover, it lived in regions where the rivers were constantly flooded and loaded with stony sediment, and where bogs were common. It died out very early in the history of man, but it lived when Europe was very different to what



WONDERFUL DISCOVERY OF THE MAMMOTH.

it is now. Many animals, some still living and others extinct, roamed through the country with the mammoth. There was a great tiger, a hyena, a rhinoceros covered with hair, the reindeer, and many kinds of bears. These companions and enemies of the mammoth left their bones in the earth, and were either destroyed by men or died off from alterations in the climate. The mammoth had teeth which were coarser in structure than those of the elephant, and it fed upon tougher food; its hairy coat, so different from the skin of the existing elephants, adapted it for a cold climate, and its tusks are sold by the thousand for ivory. Even in North America, on the shore of Behring's Straits, the frozen cliffs of mud and sea break away and disclose ivory tusks and mammoth bones, and lately, in making explorations in Rome,

mammoth bones were discovered in the mud by the side of the Tiber. Its teeth are common in England, and a great skull was found at Ilford, in Essex. An elephant fitted to live in a cold climate appears at first to be a very strange thing, but it must be remembered that the zebra can only live wild in hot climates, though the horse lives in cold; and the buffalo can only flourish in the warm countries, yet the ox, his near relation, does very well in Europe.

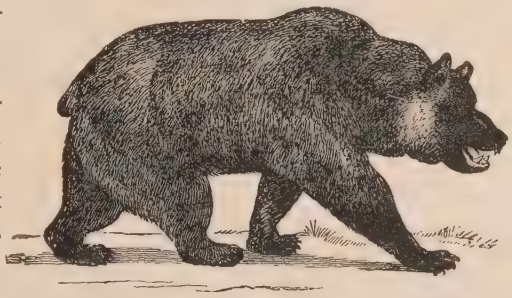
To the mammoth we must add the famous gigantic mastodon of Ohio. Whilst the mammoth has its tusks excessively curved round, the mastodon has almost straight tusks; the molar teeth differ also in each of these species. The bony remains of species of mastodon are found in the middle of America and in Central Europe.

Other extinct animals were equally remarkable. There are some hills in the East Indies, close to the great Himalaya mountains, which have large bones in them. These bones are found at some depth from the surface of the ground, and are of enormous size. They were washed down from higher ground by floods out of the bogs and marshy land, like those into which large animals, even at the present day, constantly stray and get drowned. One of the most wonderful animals whose bones are preserved in these hills is an immense tortoise. It is now extinct, and died out at the same time as a gigantic cameleopard and many kinds of immense elephants whose bones are very common in the same place. It was a tortoise which had a shell six and a half inches thick, twelve feet long, eight feet broad and six feet high. There is a curious legend which states that the world is supported on the back of an elephant, and that this creature rests on the back of a great tortoise; and it is from this legend that the creature has obtained the name of Atlas.

There are animals, however, that are never found in their native state outside of certain latitudes. One of these is the Polar bear. It has a reputation for boldness and voracity. Doubtless much of its ferocity is to be attributed to the barrenness of the regions which it inhabits, the absence of vegetation obliging it to attack animals to supply its craving appetite. Its domain includes all those solitudes which surround the Arctic Pole—Greenland, Spitzbergen and Nova Zembla. Over these vast icefields it reigns supreme. It pursues the walrus and the seal, which it catches with ease, for it both swims and dives with extraordinary skill. White bears also feed on such dead fish and cetacea as the sea throws upon the beach. In the summer time, when they betake themselves to the forests further inland, they attack the mammals which are natives of these regions, especially reindeer. But notwithstanding their apparent love of flesh, they are able to subsist upon vegetable diet.

THE FIERCE POLAR BEAR AND HIS PREY.

Most mariners who have been detained by the ice in the Polar seas have had frequent encounters with white bears. Instances have been known in which they pursued them into their vessels, even endeavoring to make their way into cabins at night through the portholes. The white bear is terrible in its attack. Accustomed as it is, to meet with little or no resistance, and not even suspecting danger, it rushes upon man with a blind fury and determination too often fatal in their results. It is not an uncommon thing for white bears to drift out to sea on floating icebergs, when they become reduced to the most frightful distress from hunger. Fatally confined to their icy raft, and utterly devoid of all means of subsistence, they ultimately attack and devour one another. Some of these famished bears have been drifted to the coasts of Iceland, and even Norway. They are then indeed terrible, and make an indiscriminate rush on anything before them, be it man or brute. Circumstances of this kind have certainly contributed to form the reputation they have acquired of untameable ferocity.



THE CALIFORNIA GRIZZLY BEAR.

Living in the midst of perpetual ice the white bear naturally dreads heat. Pallas, who observed one that was kept captive at Kranojack, in Siberia, says that it could never remain long in its house. Although the climate there is very inclement, it took a constant delight in rolling in the snow. The white bears in the Jardin des Plantes, in Paris, suffer so much from the heat of summer, that it is impossible to keep them alive for any lengthened period. Cuvier, however, says that one lived there for fifteen years, owing to the care that was taken, both in winter and summer, to refresh it by throwing over its body sixty to eighty pails of water daily.

The white bear never becomes familiar with man. When in a state of captivity it always remains wild and taciturn, and shows itself alike incapable of attachment or domestication.

In our own country the bear was formerly common, and indeed is now in the far west. Beyond the slopes of the Rocky Mountains, and in some part of California, fine specimens are to be met with which are suited to their climate and surroundings.

Seals place sentinels to watch during their sleep over the safety of the whole troop. As soon as a man or a band of white bears appear, the sentinels give vent to long-protracted howlings, and the whole company

precipitates itself into the sea. These animals mostly breed in caverns which have a seaward face; and the young are remarkably large at birth, and are then clad with a sort of fleece, which is very soon shed —indeed, sometimes even before birth. They follow their dam from the first, and appear to swim and dive with equal facility. The most effectual way of killing seals is to strike them on the nose with a club. If they are attacked with pointed arms they must be speared very deeply to put their lives in danger. When they see themselves surrounded they defend themselves courageously, but with little success. In their fury, if opportunity offers, they break the arms of their enemies between their powerful jaws. They are harpooned

A BATTLE WITH BLADDER-NOSES.

from boats, or they are pursued on the icebergs, and killed with axes and pikes, after they have made a most desperate resistance.

All the inhabitants of the shores of the Polar Seas pursue seals, and destroy innumerable quantities of them. They find in these animals precious resources against the rigor and desolation of the hyperborean climate. For the Greenlanders especially the seal is of universal utility. It yields them nearly all they want, and renders life endurable in the cold country which they inhabit. The Greenlander eats the flesh of the seal, and is contented with it, although it is tough and has a disagreeable smell. He drinks its oil, or lights his hut with it. With its skin he makes clothes, wrappers, tents, and canoes; or else cuts it

up into straps and thongs. Its muscles and tendons are converted into thread for sewing, and into strings for bows. Its blood even, mixed with other substances, forms a sort of soup. Everything, even to the membranes in the interior of the body, is turned to account; properly dried, these serve, owing to their transparency, to close the openings which admit a little light into the Greenlander's wretched hovel.

And so the chief occupation, as we may see, of the Greenlanders, is seal hunting. From their youngest days they are trained to this exercise, which is for them a matter of life and death. Sometimes they launch out to sea, in their fragile skin boats, and harpoon their prey when it comes to the surface to breathe; at other times they envelop

ESQUIMAUX WATCHING FOR A SEAL.

themselves in seal skins, stretch themselves on the shore, and endeavor to attract some unwary seal by their deceitful similitude to itself. The Esquimaux also take the seal by making a hole in the ice, and the moment one of these animals presents itself to breathe the air at the improvised skylight, they seize it.

The Americans and the English of this country are the principal people who organize seal hunting on a large scale. They fit out annually many ships, of from two hundred and fifty to three hundred tons each, for this purpose. The main object of these expeditions is to obtain the oil with which the flesh of these aquatic animals is saturated, and the fur which is one of the great articles of trade.

For a very small profit the peasants on the coast and in the isles of the Baltic brave every year the greatest dangers in pursuit of the seal. When the ice is breaking up, five, six, or sometimes fewer, embark in a canoe, with a supply of provisions and weapons. They run the risk of seeing their boat crushed between the masses of ice, or of being carried away on an iceberg, on which they will probably die of cold and hunger. A good many Norwegians perish each year on these dangerous expeditions. Seals sometimes visit the shores of the north coast of Scotland, and are occasionally hunted in a strange manner, which is not without its dangers to those engaged in this pursuit.

A SEAL MIGHT BE A PET OF THE HOUSEHOLD.

The seal is endowed with so many remarkable faculties that it seems quite suited to become one of our domestic animals; and so it is perhaps surprising that man has not yet thought of trainiug it to fish for him, as he has done with the otter. Its gentleness, its sociability, and, above all, its intelligence, which is almost equal to that of the dog, would insure it a high place in the affections of our race. There are numerous examples on record of seals which, having been tamed when very young, became so much attached to their masters as to follow them wherever they went, and returned to them even after they had purposely been left far from home. They give very little trouble: a basin filled with water in which they can bathe, and a hut with some straw in it on which they may repose, are sufficient to keep them in a good state of health. They must be fed on fish. As they devour an enormous quantity of this food, the cost of keeping them is the greatest obstacle to their ever being domesticated. It is strange, that when they are accustomed to one sort of fish they will not eat any other, and rather die of hunger than consent to change their diet.

The sense of hearing in these animals is very acute. Captain Thomas Brown makes the following remarks on this subject: These animals have a very delicate sense of hearing, and are said to be much delighted with music. The fact was not unknown to the ancient poets, and is thus alluded to by Sir Walter Scott—

Rude Heiskar's seals through surges dark
Will long pursue the minstrel's bark.

Mr. John Laing, in his account of a voyage to Spitzbergen, mentions that the son of the master of the vessel in which he sailed, who was fond of playing on the violin, never failed to have a numerous auditory when in the seas frequented by seals; and Mr. Laing has seen them follow the ship for miles when any person was playing on deck. It is a common practice in Cornwall, when persons are in pursuit of seals, as soon as the animal has elevated its head above water, to halloo to it

till they can approach within gunshot, as they will listen to the sound for several minutes. I have seen this method pursued by the fishermen at New Haven, who are very skillful in taking this animal.

A WONDERFUL AMPHIBIOUS ANIMAL.

The walrus and the various seals, of which this order is composed, present a series of characteristics which correspond exactly with the mode of life which has devolved upon them. They have the body elongated, cylindrical, representing that of a fish. Their limbs are very short, the extremities alone being visible; these are converted into fins by being provided with broad connecting webs. Their anterior extremities hang alongside the body, and act backwards and forwards, as in most aquatic quadrupeds; on the contrary, the posterior extremities, stretched out in a horizontal and parallel direction, are arranged in such a manner as to strike the water obliquely. The walrus is far more unwieldy and awkward than the seal on land, where its movements forcibly remind the spectator of the wrigglings of a gentle or fly-maggot; but it makes considerable use of its hind-legs by bringing them forward and thus taking hold of the ground, whereas those of the seals are more directed backwards.

The walrus is covered with short scanty hair of a dark reddish color; its muzzle is large and puffed out at the upper part, and is terminated in a snout, in which are the nostrils, which are turned upwards. Altogether, it is a creature of a massive and unwieldy appearance. It possesses two powerful canine teeth, which, descending vertically from its upper jaw, project somewhat outwards, and constitute formidable weapons. It inhabits exclusively the Arctic Polar regions: it is especially common in the neighborhood of Spitzbergen, of Nova Zembla and on the coasts of Siberia. It disports itself with ease in the water, feeding on shelled mollusks, which it detaches from the submerged banks by means of its tusks, which act like garden rakes. Its gullet is too small to swallow a fish larger than a herring, and it is now certain that this animal subsists mainly as described. Its long canine teeth are, above all, very useful to it in hoisting itself up on the shores, or over the ice which is in its way; they serve it also as points of support, and assist it to advance, by drawing it along on its front legs. It often mounts upon floating icebergs, on which it will drift about for hours together. Naturally mild and inoffensive, the walrus becomes very bold when it is attacked and wounded. Under such circumstances it will fight with the utmost fury, and will show its desire for vengeance by all its actions. If on land, and consequently incapable of pursuing its enemies, its feeling of helplessness makes it utter furious cries; it tears up the soil with its tusks, and attacks everything it meets with on its way. But to

avoid being injured by it, after it is wounded, all that is necessary is for the hunters to keep at a respectful distance. In the sea, on the contrary, where it can display all its activity, the walrus is rather to be feared; so much the more so on account of the strict union in which it lives with its fellows, who never fail to come in great numbers to help any of their companions which are threatened with danger. They surround the boat, and try to sink it by running it through with their tusks, or capsize it by bearing with their whole weight upon its sides. Sometimes, indeed, they even try to board boats, much to the disgust of the sailors, who have no wish for such company. If the boats row off, they follow them for a long while, and only stop when they are out of sight.

THE VICTIMS OF A TERRIBLE WARFARE.

The walrus has to struggle, not only against man, but also against the bears which inhabit the same latitudes. Although the white bears are provided with formidable means of attack, they do not always come out of the combat victorious. The deep wounds which they carry away with them after their battles with the walrus sufficiently attest the valor and power of the animals which they wished to make their victims. Formerly the walrus existed in such great quantities in certain parts of the icy Arctic Ocean, and were at the same time so bold, that they allowed themselves to be approached by bands of sailors without attempting to escape; so that prodigious numbers of them could be destroyed without any great difficulty.

Having learned a lesson from experience, the walruses keep together in bands more or less numerous on the rocks and icebergs; they go but a short distance from the sea, so as to be able to plunge into it on the least alarm; they, like the seal, place sentinels during their sleep, so as not to be taken by surprise. Generally, it is necessary to take to the boats, to row after them, and harpoon them in the water.

Walruses supply diverse products of considerable importance in trade; it is for this reason that such deadly war is waged against them. In the first place their tusks provide us with a grainy ivory, harder and whiter than that of the elephant. These tusks detach themselves when the animal's head has been boiled in a cauldron of water. An oil of a better quality than that of the whale is extracted from their fat; each walrus produces half a ton of it. Lastly, their skins, properly cured and tanned, become very thick and substantial leather, which is employed in carriage-making. In the middle ages, cords and cables, of a solidity which was proof against everything, were made of this leather. Albert le Grand, in the fourteenth century, relates that this skin had a great commercial value in the market of Cologne. The walrus was unknown to the ancients.

A traveler in the East gives us the following interesting sketch of one of his experiences. About eight miles from Kurrachee, in Scinde, is a place well worth inspecting to all who are fond of the monstrous and grotesque. A moderate ride through a sandy and sterile tract, varied with a few patches of jungle, brings one to a grove of tamarind trees, hid in the bosom of which lies the grisly brood of monsters. Little would one ignorant of the locality suspect that under that green wood, in that tiny pool, which an active leaper could half spring across, such hideous denizens are concealed. "Here is the pool," I said to my guide rather contemptuously, "but where are the alligators?" At the same time I was stalking on very boldly, with head erect, and rather inclined to flout the whole affair. A sudden hoarse roar or bark, however, under my very feet, made me execute a pirouette in the air with extraordinary adroitness. I had almost stepped on a young crocodilian imp, about

EGG OF THE ALLIGATOR, NATURAL SIZE.

three feet long, whose bite, small as he was, would have been the reverse of pleasant. Presently the genius of the place made his appearance in the shape of a wizard-looking old Fakir, who, on my presenting him with a couple of rupees, produced his wand—in other words, a long pole—and then proceeded to "call up his spirits." On his shouting "Ao! ao!" (come, come) two or three times, the water suddenly became alive with monsters. At least threescore huge alligators, some of fifteen feet in length, made their appearance, and came thronging to the shore. The whole scene reminded me of fairy tales. The solitary wood; the pool with its strange inmates; the Fakir's lonely hut on the hill side; the Fakir himself, tall, swart and gaunt; the robber-looking Beloochee by my side, made up a fantastic picture. Strange, too, the control our showman displayed over his "lions." On his motioning with the pole they stopped, and, on his calling out "Baitho" (sit down), they lay flat

on their stomachs, grinning horrible obedience with their open and expectant jaws. Some large pieces of flesh were thrown to them, to get which they struggled, writhed and fought, and tore the flesh into shreds. I was amused with the respect the smaller ones showed to their overgrown seniors. One fellow, about ten feet long, was walking up to the feeding ground from the water when he caught a glimpse of another much larger just behind him. It was odd to see the frightened look with which he sidled out of the way, evidently expecting to lose half a yard of his tail before he could effect his retreat. At a short distance, perhaps half a mile, from the first pool, I was shown another, in which the water was as warm as one could bear it for complete immersion, yet even here I saw some small alligators. The Fakir told me these brutes were very numerous in the river about fifteen or twenty miles to the west. The monarch of the place, an enormous alligator, to which the Fakir had given the name of "Mor Sahib" (My Lord Mor), never obeyed the call to come out. As I walked round the pool I was shown where he lay, with his head above water, immovable as a log, for which I should have mistaken him but for his small, savage eyes, which glittered so that they seemed to emit sparks. The Fakir said he was very fierce and dangerous, and at least twenty feet in length.

THE BONE-PLATED ARMADILLO.

There is an animal which is met with in South America whose construction is most remarkable. The armadillos are distinguished by the very peculiar nature of their outward integument, which, at first sight, might lead to their being taken for reptiles. Instead of being clad in hair, like other mammals, they have the upper part of the head, the top and sides of the body and the tail protected by a scaly cuirass, very hard in its nature. This cuirass is composed of a number of bony plates, arranged in parallel rows and of various shapes; it is not separate from the skin, but forms a very curious modification of it. On the head, the fore and back part of the body, these plates are firmly fixed to one another; but on the middle of the back they are possessed of a certain amount of mobility, so as to move one over the other. In this way the animal has the power of executing various bending and stretching movements; for instance, of rolling itself up into a ball whenever it is attacked, so as to hide under its cuirass.

The other characteristics of the armadillos are short legs, provided generally with five toes, terminated by long claws, which are used to scratch up the ground; ears pretty well developed, upright, and pointed; nostrils perforating an elongated snout, and detecting very acutely any odoriferous emanation; a tail either long or rounded, or short and flat. In some species, the number of teeth is considerable: the great armadillo has no less than ninety-eight.

The armadillos are natives of the great plains of South America, where they dig burrows, composed of one chamber, entered by numerous passages. They feed partly on vegetable and partly on animal substance, more especially insects and carrion.

They are inoffensive and harmless in their nature. Their size is generally small; the largest species—that just alluded to, which considerably exceeds all the rest—is not much more than a yard in length. The smallest of the species is about the size of a rat.

Some domestic animals show a remarkable intelligence, and are capable of a high degree of education and training. The late Honorable Alexander H. Stephens had a dog that shared the fame of his master. The name of Rio has become historic. He was Mr. Stephen's companion and pet. The first thing in the morning upon rising and issuing forth, was a jolly frolic with his dog. Rio always slept in the same room with him, and when the master was ill and confined to his bed, the faithful brute was never out of the room save for a few moments at a time, for days and weeks together. He accompanied his master almost everywhere he went. He was as well known on the railroads throughout the State of Georgia as the statesman himself, and we have heard much, gravely told, of the sagacity of this remarkable animal, which would be incredible to readers who did not know him. All that Youatt says of the poodle, as a species, is true of this specimen, and much more. He would close a door quickly and quietly upon being told, or bring a hat, cane or umbrella from another room upon a like command. He not only knew the names of all the household, but actually seemed to understand the subject-matter of conversation. When orders were given by his master to have his trunk brought out to go anywhere, Rio did not need the appearance of the article to manifest his understanding and readiness to go. When left behind, he would go to the depot each day on the arrival of the trains, and if his master did not get out would go through all the cars looking for him. The conductors all knew him, and what he was about; and if, as sometimes happened, he did not get through his search before the cars started, the train was stopped for him to get out. When the master happened to return by any other conveyance, a

servant had only to say, "Rio, Mas' Alex's come!" and the dog bounded off with all possible speed to welcome and literally embrace him. His joy was manifested not only by putting his great paws on his breast, but by loud and protracted barking. Return from an absence was always announced to the village by the well-understood signal of Rio's bark.

This dog's intelligence was scarcely more surprising than that sometimes found among other domestic animals. It is on record that a shoemaker in one of our large towns chanced to leave the door of a lark's cage open, of which the bird took advantage to fly away. About an

THE CELEBRATED RIO.

hour afterwards, a cat belonging to the same person, made its appearance with the lark in its mouth, which it held by the wings over the back in such a manner that the bird had not received the least injury. After dropping the bird on the floor, the cat mewed and looked up to her master as if expecting his recognition of her cleverness. Many instances of a remarkable instinct in cats are narrated. One of these animals every day knocks at the door of one apartment in the house, sometimes modestly, sometimes with a sharp double knock, occasionally with a series of raps, pianissimo, like a lady or a quiet, single gentleman. The door is half glass and the knocker low. The cat was not taught, but acquired the trick by his own observation

Some very low orders of life are a surprise to the naturalist, and his astonishment only increases the farther he pursues his investigations. The virulence of the poison of the rattlesnake, for instance, is well known. Doctor Burnett, of the Boston Society of Natural History, states there is good reason for belief that the action of this poison is the same upon all living things, vegetables as well as animals. It is even just as fatal to the snake itself, as to other animals; for another naturalist states that one of his specimens, after being irritated and annoyed in its cage, in moving suddenly, accidentally struck one of its fangs into its own body, when it soon rolled over and died. Here, then, we have the remarkable, and perhaps unique physiological fact, of a liquid secreted directly from the blood, which proves deadly when introduced into the very source (the blood) from which it was derived.

LEECHES ATTACKING TRAVELERS.

Of all the plagues detested by travelers, the land leeches of Ceylon are the worst. They exist in thousands, and though not visible when the weather is hot and dry, a smart shower brings them out of their lurking-places, and they lie in wait for the first passer-by with all the cunning of brigands. Sir Emerson Tennant describes them as being about an inch in length, and as fine as a common knitting-needle; yet they are capable of distension till they equal a quill in thickness, and attain a length of nearly two inches. They have the power of planting one extremity on the earth, as if it were held down by a sucker, while the head is raised to watch for their victims. On descrying their prey, they advance by semicircular strides. Fixing their mouths on the ground, they move forward their tails, and so proceed mouth and tail alternately with the greatest rapidity until they lay hold of the traveler's foot, and ascend his dress in search of an aperture by which to enter. They are so flexible that they can insinuate themselves through the meshes of the finest stocking, and when they once reach the skin they ascend even to the back and throat, and fasten on the tenderest parts of the body. In these encounters the individuals in the rear of a party of travelers are sure to fare worst, as the leeches, once warned of their victims' approach, congregate with wonderful celerity. Their size is so insignificant, and the wound they make so skilfully punctured, that both are generally imperceptible; and the first intimation of their onslaught is the trickling of the blood, or the chill feeling caused by the leech when it begins to hang heavily on the skin from being distended by its repast.

CHAPTER VII.

WONDERFUL BIRDS.

Enormous Birds of Ancient Time—The Condor—The Famous Dodo—Eagle and Fish Hawk—Rooks Holding a Convention—Wonderful Bird of Paradise—The Humming Bird—The Curious Moth—A Bird that Rings a Bell—Ingenious Nests—The Flamingo—The Frigate Bird—Mysterious Butter Bird—The Hornbill—The King Penguin—Talking Birds—Parrots—The Handsome Hoopoe—The Cuckoo—The Pretty Fly Catcher—The High-Flying Kite—The Lanner Falcon—The Java Bat—The Bittern—The Thrush—Nests that are Eaten—Turtle Dove—Ring Dove—The Marvelous Cockatoo—Interesting Lessons from Bird Life.

SEVERAL years since some bones of a huge bird were found in the islands of Madagascar and New Zealand, and they were supposed to belong to extinct birds which were very much the same in shape; but lately some of the remains of the epiornis of Madagascar (named from the Greek for tall bird), have been studied by an anatomist, who asserts that they belonged to a gigantic bird of prey, like the condor of the Andes, or the eagle of the mountains of our own country. The great bird was at least ten feet high, and its eggs, many of which were found with the bones, are fourteen inches long. A bird of prey, with its leg bones longer and thicker than the corresponding bones of the largest man that ever lived, and which had eggs six times the size of those of the ostrich, and one hundred and forty-eight times the size of those of the common fowl, must have been at least many times larger than the greatest condor. If the condor and the eagle can carry off a goat or a lamb, what might not the epiornis have pounced upon and removed? The condor has a great length of wing, and swoops down from eight thousand to ten thousand feet with great velocity, and when it is attacked will give much trouble to a single man. The epiornis, with his height of ten feet, would have measured thirty-seven feet from the tip of one wing to that of the other. If this new idea of the habits of the epiornis is correct, the bird may certainly have carried off ten times the weight that a condor could lift.

It is very probable, when the nature of the soil in which the bones of the epiornis have been found is considered with a view to calculate the lapse of time since it was deposited, that there is some reason to believe that the first men who emigrated to Madagascar destroyed the great

bird. It is therefore probable that the great epiornis was the roc of Indian story, and that as years progressed the truth was lost sight of in the desire for the marvelous. The size of the bird cannot be doubted.

There are some doubts whether the epiornis was not like a huge bird whose remains are often found in the caves and bogs of the islands of New Zealand. This bird was something like a gigantic ostrich or cassowary. It had bones more like those of a beast than a bird, as regards their length and strength; and one kind had what is called the drumstick bone of the leg at least three feet in length, whilst another had a foot which covered as much space as the sole of an elephant. The bones of this great foot were as large as the toe-bones of an elephant, and the whole bird must have been about ten feet in height. It had no wings, but a long neck and a small head. The tail was short, and the legs enormously long. The feathers were very hair-like, and there was no power of flight. The bird could stalk along like a fowl, could stride over many yards, and was able to run and jump at a great pace. The huge toes were admirably suited for scraping and grubbing up the tough roots and other vegetable substances which were the food of the bird. The dinornis, as the bird was called (from the Greek for awful or huge bird), was not a bird of prey, but a shy and fleet creature, whose strength of leg was enormous. Overtopping the tallest men, and having a long, erect neck and a proud-looking head, this bird must have astonished the earliest native settlers of New Zealand who have left many stories concerning the gigantic moa, as they called the dinornis.

The dodo is one of the curiosities of natural history, on account of the entire extinction of the bird, and the paucity of its remains. Till a short time ago, nothing but a few fragments of its bones, and those scattered through several museums, were known to exist. In 1866, however, a collection of bones was discovered in the island of Mauritius. These comprised no fewer than a hundred bones and fragments, which had apparently belonged to four or five dodoes, somewhat differing from each other in size. The dodo was undoubtedly a pigeon, but it was flightless, and its structure was modified in conformity with this circumstance. It was somewhat larger than a turkey-cock, and the above discoveries completely authenticate the well-known portrait of the dodo. It was addicted, in some measure, to animal food, and it was doubtless this fact that made its flesh less palatable to the Dutch settlers of the sixteenth and seventeenth centuries, than they found that of the pigeon. A specimen of the dodo was exhibited in a show, and the keeper used to point out a heap of pebbles, some of which were as large as nutmegs, and which, he said, the creature ate.

There is a fierce bird of prey called the fish-hawk, the proper name of which is the asprey. He pounces on the fish, as the rest of the sea-birds do. First he wheels round, then he poises himself in the air, and then he drops, swift as an arrow. In a few seconds he appears again, the water dripping from his plumage. He carries a fish in his mouth, which is still alive and struggling. But none of these birds seem sure of their prey, even when they have snatched it from the waves.

THE WONDERFUL SEA-EAGLE ATTACKING A FISH-HAWK.

It often happens that the great sea-eagle is close at hand. The eagle loves the lonely shore, and the steep, wild rocks. He has been perched on some tree or crag watching the fish-hawk. Now the time has come for action. He stretches his wings, bends his white head, and swoops like a thunder-bolt on the fish-hawk, which, in his fright, drops his prey, which is snatched up in a moment, and carried off by the eagle in his talons. The sea-eagle lives chiefly on fish, and has his nest by the sea. He drops with such violence on his prey that the Italians compare it to the falling of a piece of lead. They call him the leaden eagle, and he is dreaded by the people who live near the coast. He will carry off lambs from the flock, and all the smaller animals he can get; and he will even

attack the cattle. No one who has not seen the manner of attack would believe it possible. First, the eagle dashes into the sea and wets his plumage; next, he rolls himself on the beach until he is covered with sand. After that, he rises up into the air and hovers over an unfortunate ox. The ox goes on quietly feeding, until, all at once, a shower of sand comes into his eyes. The eagle has flung the sand, and now he begins to clap his wings and fling more sand, and startle and terrify the ox as much as he can. He even strikes it with blows from his great strong pinions. The ox is half-blinded, and so frightened that it almost loses its senses. It runs headlong hither and thither, until at length it either drops down from fatigue, or rushes over the cliff, and being dashed to pieces, becomes an easy prey to his enemy. Now and then the eagle meets with his match, for instance when he attacks the dolphin. The dolphin is a sea-animal, a little like a whale, only not so large. The claws of the eagle are entangled in the skin of the fish. He cannot get them free, and as the dolphin dives to the bottom of the sea, it carries the eagle with it.

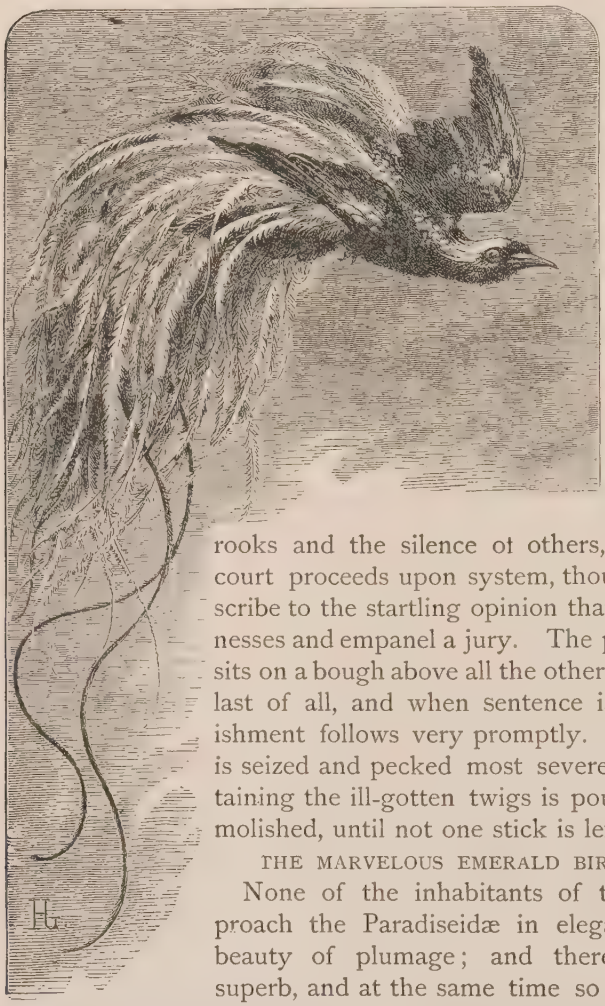
A very different bird from the pugnacious, ravenous eagle is the harmless pigeon, beautiful in appearance, and far more capable of being domesticated than the wild bird of the forest and mountain.

A vast army of pigeons makes its home in the forests of our country. If you went into the forest where they live, you would find the trees beaten and broken. Great branches lie strewed on the ground. And the ground is as much trampled down, as if an army of soldiers had been there. The pigeons have done all the mischief. When they have eaten up all the nuts and acorns, and every bit of fruit they can find, and have destroyed as much as they have eaten, they go to another place. The whole army of pigeons rises into the air with a rushing noise like thunder. They fly so high that nobody can shoot them.

Accounts are given of a very remarkable flight of these birds in one of our Western States, which lasted several days. It was a wonderful sight. The air was full of pigeons. On they swept—and on—and on. There seemed no end to them. Their wings shone and glistened in the sun; and looked now green, now purple, and kept changing color every minute. For three days this army of pigeons kept flying past. It was a mile in breadth; and it was two hundred and forty miles long! The rushing noise made by the wings of the pigeons was so great, that horses on the road took fright, and people could hardly hear themselves speak. This strange flight is a matter of history.

Another bird, the rook, has very singular habits and characteristics. Rooks, like men, have not all the same nice sense of justice. Some of them are honest, obliging and industrious, others knavish, idle and

mischievous. In the spring months in particular, when they are all busy building nests, or repairing old ones, certain evil-doers invade their neighbors' store of sticks to save themselves the trouble of collecting materials in a more laborious and lawful way. This, to some, may appear a very venial crime, but what a plank is to a carpenter a twig is to a crow, and to pilfer the one is as bad as to purloin the other. But as often as offences of this kind are detected, a complaint is made to the proper quarter, and the delinquent tried and punished by his peers. Some veteran bird acts as chief justice, and from the bustle that goes forward, the cawing of some rooks and the silence of others, it is plain that the court proceeds upon system, though we cannot subscribe to the startling opinion that they examine witnesses and empanel a jury. The presiding rook, who sits on a bough above all the others, is heard croaking last of all, and when sentence is pronounced punishment follows very promptly. Either the culprit is seized and pecked most severely, or the nest containing the ill-gotten twigs is pounced upon and demolished, until not one stick is left upon another.



THE MARVELOUS EMERALD BIRD OF PARADISE.

None of the inhabitants of the bird world approach the Paradiseidæ in elegance of shape and beauty of plumage; and there is something so superb, and at the same time so unearthly, in their appearance, that it is hardly to be wondered at if the fancy of the early voyagers supposed them to be fit denizens of the Garden of Eden. The most extraordinary legends at one time prevailed about them. It was said that they lived wholly upon dew, and passed their lives in long aerial voyages: that they so spurned the earth as never to touch

it until the moment of death approached; that they never rested except when suspending themselves from the branches of trees by the shafts of their two tail-feathers; and it is still a belief of the Malays that for raising their young they retire to the untroubled groves of Paradise. These fables partly arose in their peculiar habits, and partly in the Papuan custom of tearing off their legs before sending them to market, which led the European navigators to suppose that they were all wings and body. Then, again, owing to the singular looseness of their plumage, they always fly against the wind. Add to this, that they dwell in the recesses of the vast virgin forests, afar from the haunts of men, and that their song or cry is very characteristic, and it is not difficult to understand how they came to be invested with so many fabulous attributes, and made the subjects of so many romantic stories.

The Paradiseidæ are confined exclusively to the Australo-Malay Islands—having probably their true habitat in Papua or New Guinea. In the tropical forests of these islands they live in large troops; and as they fly on undulating wing, or perch on the summit of the tallest trees, they lend an additional beauty to the landscape by the rare splendor of their many-colored plumage. They shun the noontide heat, and seek their food, which consists principally of fruit, in the morning and evening. They show a great partiality for the fruit of the fig and teak trees, but do not disdain an occasional meal of insects, of which, however, they reject the horny or scaly case, legs and wings. They are polygamous; that is, the male has several mates, from whom he is easily distinguished by the superior bravery of his appearance. Moreover, they recognize a form of government; a flock of forty or fifty birds flying always under the direction of a single bird, which the Papuans call their chief. Their cries are very peculiar, and seem to differ according to the meaning they are intended to convey; their congratulatory note, on meeting one another, resembles the cawing of a raven, but is more diversified in its gradation, and may be expressed as "he, he, ho, haw," frequently repeated and rapidly. Sometimes they appear to issue a call or summons, the notes resembling the syllables "whock, whock, whock," uttered in a kind of barking tone, and so loudly as to be audible at a considerable distance

The best-known species is the emerald bird of paradise, of which it has been said that it possesses plumage which in one part glitters with all the dazzling, gem-like hues of the humming-bird, in another is soft, warm, and delicately tinted, and in another is dyed with a rich intensity of coloring that needs a strong light to bring out its depth of tone; and yet the torrent of graceful and softly-tinted plumes that flow with such luxuriant redundance of changeful curves over the body, are in them-

selves sufficient to place the emerald bird of paradise in the first rank of beauty. It is the queen of all wonders found with wings.

It has been asserted of this glorious creature, that it surpasses in beauty the whole of the feathered creation. This is a bold eulogium, but we are not disposed to quarrel with it; nor will the reader, if he succeeds in realizing to himself what manner of bird it applies to :—a throat of the brightest emerald; a canary-tinted neck shading its color gradually into the fine chocolate of the other parts of the body; wings of a warm reddish-brown, like the leaf of the chestnut in autumn, from which droops, as it were, a cloud of loose, golden plumes, in graceful, feathery tufts. The chocolate-colored tail is short, but projecting from it are two very long shafts of the same hue, longer even than the silken plumes of the sides. Surely, the fairy creature which is clothed in plumage of this bright and varied character must be "a thing of beauty" and "a joy for ever!" It would be worth a voyage to see it fluttering through its leafy forest-haunts, and streaming its brilliant plumes against the wind! In color it is nothing less than a flying rainbow.

THE BEAUTIFUL HUMMING-BIRD.

Under the shade of a tree, at the end of one of the twigs, hangs a tiny little nest. It hangs in the air, and is as light as a feather. It is made of moss, and down, and whatever the bird could find. It is very snug, and two eggs the size of peas, and as white as snow, lie within it. Flowers scent the air, and yonder is a deep wood. The bird is about the tiniest creature you ever saw. Its body is no bigger than a walnut, but its feathers are more lovely than can be described. It has a green crest, on its head, which sparkles like a little star. The colors on its body are green, and gold, and purple. You can scarcely tell where one ends, and another begins. Humming-birds live in many places where it is hot. They are found in India, and in our own country. The woods and groves are alive with them. They flash about here, and there, clad in the fairest, brightest colors The eye is never tired of watching them.

The humming-bird will finish her dinner with a sip of honey, but she also wants something more substantial. There are a great many insects hidden at the bottom of the flowers. She spies them out, with that bright eye of hers. Then she darts her long tongue into the middle of them. An insect sticks to it, for the tongue is sticky, as if it had been rubbed with glue. The insect is drawn into her mouth; she swallows it, and then darts out her tongue for another. All this time, she is hovering over the flower, and humming with her wings. When she has had enough insects, she sips a little honey, and flies back to her nest.

There is a singular, winged little creature to be met with in South America, which is quite as wonderful as the bird just described, and, in fact, much like it. A traveler has thus referred to it: A little girl of our party came running to me, and with face all aglow, said, "I have not shown you my humming-bird yet. I keep it in a cage in the house for fear the others should get at it; but it takes a flight by itself every day, and comes back again when it wants a sip of sirrup, or wishes to go to roost. I must show you some nests of the beautiful little birds which they have built not far off." I accompanied her to a little distance, where, hanging to some long, pendant leaves, she pointed out two little purse-shaped nests, composed, apparently, of some cottony material bound together with spider-web. A graceful little bird was sitting in each of them, with tails having long, pointed feathers. The upper part of their bodies were of a green bronze, except the tail-coverts, which were of a somewhat rusty red; while the tails themselves were of a bronzed tint, broadly tipped with white. While we were looking, the mate of one of the birds came up and perched close above the nest. As we were going away I saw two others pass by us, of the same size, it seemed to me. Another settled on a flower near at hand, when the idea seized me that I could catch it. I struck it with my hat, and down it fell. Stooping down, what was my surprise to find, instead of a humming-bird, a moth so exactly in shape and appearance like the humming-birds, that it was no wonder I had been deceived. The moth, however, though stunned, was not killed. On taking it to the hut I compared it with her tame pet, and was struck by the remarkable similarity in the shape of the head and position of the eye. The extended proboscis represented the long beak of the bird, while at the end of the moth's body was a brush of long hairs, which, as it flew along, being expanded, looked very much like the feathers of the bird's tail. The resemblance, of course, is merely superficial, their internal construction being totally different.

THE WONDERFUL BELL-BIRD.

Continuing our journey as we were paddling on, we were almost startled by hearing a sound like a bell tolling in the midst of the forest. It ceased, and we paddled on, when again it struck our ears loud and clear. Again it came within the space of a minute, and we almost expected to see some church steeple peeping forth through an opening in the primeval forest. We tried to ascertain from our young Indian companion what it could mean, but he only nodded his head, as much as to say, "I know all about it," and then he gave a glance down at his bow and quiver which lay by his side. We went on for some minutes more, the sound of the bell reaching our ears as before, and then began to

look up eagerly into the trees. Suddenly we saw, on the topmost bough of a tree overhanging the water, a beautiful white bird, about the size of a jay. At the same time there came forth from where it stood a clear bell sound, and we saw from its head a black tube, rising up several inches above it. Our Indian boy cautiously put his hand out and seized his bow. In an instant he had fitted an arrow to the string. Away it flew, and down fell the bird fluttering in the water. We paddled on, and quickly had it on board. I could not help feeling sorry that he had killed the beautiful creature, whose note had so astonished us. It was, I found, a specimen of the somewhat rare and very wonderful bell-bird. From the upper part of the bill grows a fleshy tubercle about the thickness of a quill, sparingly covered with minute feathers. It was now hanging down on one side, quite lax. It was evident, therefore, that the bird, when alive, elevated it when excited by singing or some other cause; indeed, afterwards, on examining it, we found it connected with the interor of the throat, which further convinced us of this fact, and made it plain beyond question.

NESTS OF THE PENDULINE TITMOUSE.

A large volume might easily be written on the wonders of bird's nests. Every different kind of bird has a different kind of nest, and each pair always adhere to the peculiar style of architecture of the particular species to which they belong. So characteristic is the nest, that an experienced collector could, when shown one, immediately name the bird by which it was constructed.

Birds themselves differ so much in form, in size and in their modes of life, that we should expect to find great differences in the require-

ments of their young; but it would be a hopelessly long task to attempt to give even an outline of the various constructions which are employed. All we shall do will be to mention some of the most curious of these beautiful contrivances, and to point out, wherever possible, the reasons which appear to have guided the little architects in their plan.

There is a little bird found in India, and known by the name of the tailor-bird. On a leaf or two at the extremity of a slender twig is the little cradle made. If one leaf be sufficiently large, the edges are drawn together so as to form a pouch, in which the nest is formed. To preserve the pouch, the parent birds twist vegetable fibre into a fine thread, and by the help of their bills and feet actually bore holes through the edges of the leaf and stitch them together. If one leaf be considered too small, then another growing by, or a dead one, is stitched on to it, so as to form a pouch roomy enough to contain the expected family. The inside is then completed by being carefully lined with down and feathers. This is truly a rocking-cradle, for, hanging from a leaf, it is, of course, moved by every breath of wind; but the little tailor-bird has a formidable enemy, which it is necessary to avoid. Tree-snakes infest the trees in India, and young birds and eggs form their favorite prey. Did the tailor employ his art anywhere but on the finest twigs, the snake would be able to visit his domicile; but by placing his nest in the position he selects, the unwelcome intrusions are completely prevented.

The nests of the pensile weaver-bird are also curiosities. They are always suspended from the twigs of trees overhanging water, and form an object of curiosity to the traveler in Africa. Each consists of a hollow globe, which, when rendered soft and warm by being lined with feathers, constitutes the nest properly so called; but the peculiar feature of this construction is the passage by which the weaver enters his home. There is a tube about a foot or fifteen inches in length, made of the same material as the nest; one end of this tube opens into the chamber, the other goes down to within a few inches of the surface of the water. Into this nest none but a flying creature could enter. It cannot be approached but by the tube, and to the mouth of this tube there is access neither by land nor water, but only through the air. The object of this curious contrivance is doubtless the same fear of snakes which guides the tailor-bird. The instinct of these ingenious creatures shows them how to evade their active and insinuating enemy, who dares not venture out upon the slender twigs from which these nests are suspended. The weaver-birds are so called from the mode in which they make their nests and the tubes which hang from them. These are formed of dried grasses, which are so beautifully interwoven as to form a very compact

and strong case. Thus these birds have anticipated man in weaving, as the tailor-birds have in sewing.

The nests of the sociable grosbeak, a bird found in South Africa, are worthy of notice. It may be described as a colony of nests packed under one roof. Like our common crow and many other birds, the grosbeak is fond of the society of its kind; but, unlike them, it is not satisfied with having its neighbor's nests on adjacent branches of trees; they must all be close together. When a number of these birds agree in forming a habitation, the first thing to be made is the roof. A large and lofty tree is selected, and in the topmost branches of this the birds, numbering perhaps some hundreds, commence their labors. With coarse grass they form the roof, strengthening it by interweaving the fibres; this having been accomplished by the joint efforts of the community, each individual pair constructs its own nest under the shelter thus provided. These are placed side by side, and when the whole are finished the entire under surface is covered with the circular openings leading to each nest. Three or four eggs are laid by each female, and as many as three hundred and twenty nests have been counted under one roof. The feeding and rearing of a thousand young makes a very busy [illegible]ne.

NESTS OF THE CAPE TITMOUSE.

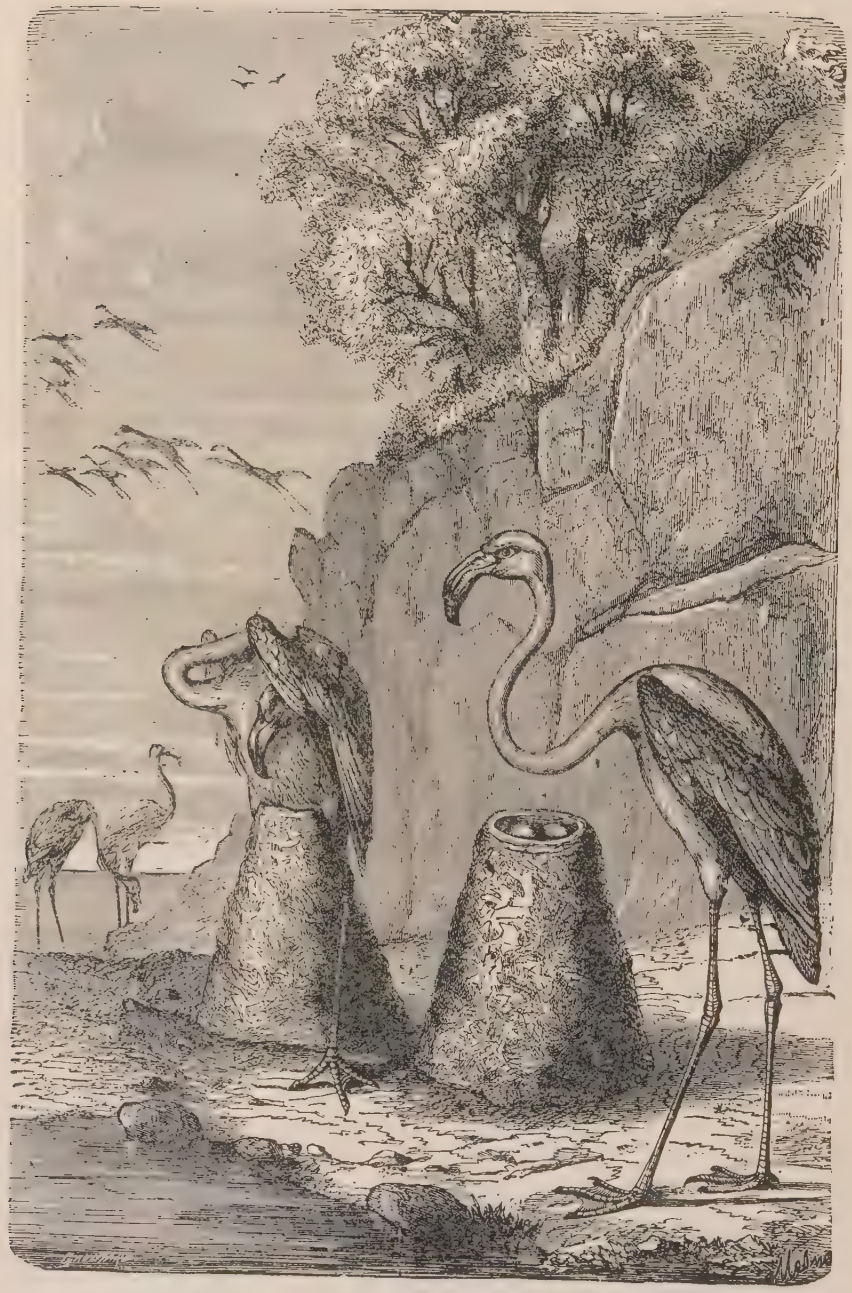
It is not known what may be the object which is gained by this union of birds into a republic; possibly it may be for mutual protection against some common enemy.

Not merely in nest-building do the feathered tribes show their instinct and sagacity. Mr. Ball, the eminent naturalist, relates the following anecdote of a raven. When he was a boy at school, a tame raven was very attentive in watching their cribs or bird-traps, and when a bird was taken, the raven endeavored to catch it by turning up the crib; but in so doing the bird always escaped, as the raven could not let go the crib in time to seize it. After several vain attempts of this kind, the raven, seeing another bird caught, instead of going at once to the crib, went to another tame raven, and induced it to accompany him, when the one lifted up the crib, and the other bore the poor captive off in triumph.

THE SAGACIOUS CROW.

From the nest of the smallest bird we pass to that of a great bird upwards of five feet high. It is found on the sea-coast of Africa, and is called the flamingo. The plumage of these noble birds is most splendid, being a combination of carnation hues with delicate white. A row of them standing together is a most striking spectacle. The neck is long, but the bill is so strangely shaped that it seems difficult to understand how it is used for procuring food. The nest is curiously constructed, and their mode of sitting upon it is most extraordinary. They scrape together a hillock of earth; then, a hole having been made in the top, two or three eggs, each as large as a goose-egg, are laid. The female sits upon them, with her legs resting at either side on the ground, or sometimes even in shallow water, from which, as a sort of island, the hillock rises.

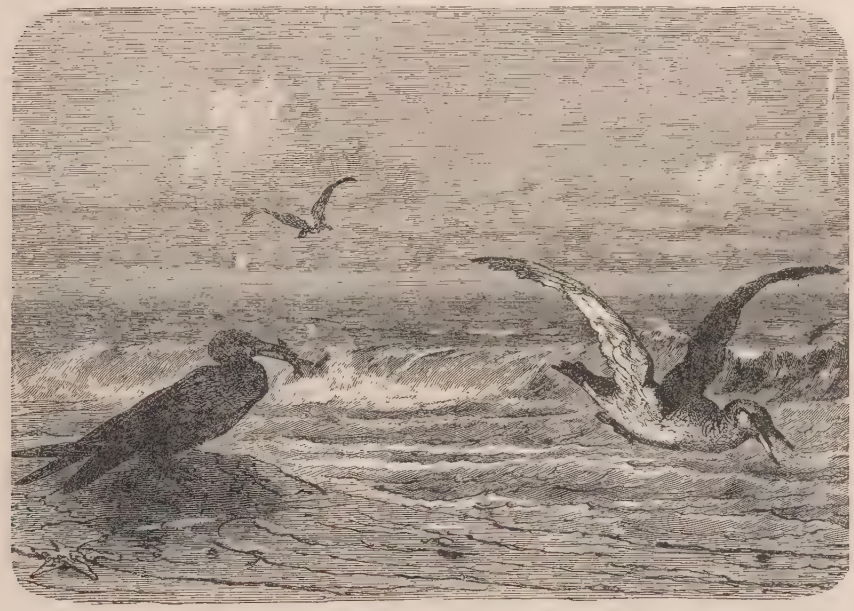
One of the greatest wonders in natural history is the flight of birds. We have been all our lives so accustomed to see birds, that we are not ne[illegible]one to marvel at the wonders of their flight. We must meditate



THE IMMENSE FLAMINGO AND ITS CURIOUS NEST.

on the beautiful arrangements by which they are enabled to raise themselves in the air and propel themselves through it, and we must remember how utterly futile all man's attempts to fly or make flying-machines have proved, and then we are in a condition to appreciate the marvel which is daily before our eyes.

The frigate-bird is endowed with magnificent powers of flight. His wings stretch to an expanse of about ten or twelve feet; his body is about three feet long; his bill is very powerful, and adapted for seizing. His feet are webbed, but very small; he has but little use for them, his home being in the air, hundreds of leagues away from land, He is seen soaring high above the ocean, but on its bosom he never rests. When



THE FAR-FLYING FRIGATE-BIRD.

he seeks repose he finds it aloft in the air. His foot rarely touches land except at the time for pairing, making nests, and rearing young. How is all this? The expanse of his wing is so vast, and his body is so light, that he can soar with little or no exertion. Still it is difficult to see how this would enable him actually to sleep on the wing, as it is believed he does. A more close examination shows, however, that his bones are hollow, and that there is a large pouch communicating with his lungs and with the cavities in the bones. This pouch he can inflate with air, and thus render himself buoyant; the sustaining power thus acquired, added to that of the wings is sufficient to keep him up.

If his home be in the air, if he neither dive into the sea for fish, nor

search on the land for other food, whence does he derive his sustenance? Impelled by hunger, he descends from the lofty regions where it is his delight to dwell. Whether the sea be rough or calm, he glides along over the water, and any unwary fish approaching the surface, on being detected by his keen eye, is pounced upon instantaneously and swallowed, his dexterity in fishing being most extraordinary.

But the frigate-bird has other resources; though he cannot dive into the sea to catch fish, he avails himself of the labors of birds which can. He watches one of the birds which dive; he sees him emerge successfully, and fly off with his prey. Instantly the frigate-bird is down upon him with a swoop of terrific velocity. The frightened diver drops his fish in mid-air; the frigate-bird poises himself again, darts down with another swoop, and seizes the fish ere it reaches the water.

THE MYSTERIOUS BUTTER BIRD.

Humboldt records a visit to Caripe, in South America, where is the cavern of the guacharo bird; and our knowledge of this wonder is derived from his most interesting narrative. Among the natives in the country around, this cavern is celebrated for its great size, for the mysterious birds which haunt its inmost recesses, for the river which flows from it, and for the superstitious belief that in its gloomy depths is the abode of the spirits of their departed ancestors. The name which it bears signifies "the mine of fat," because from the young of the birds which inhabit it an immense quantity of fat is annually obtained. These birds are about the size of our common fowl, with wings which expand to three feet and a half. All day long they dwell in the cavern, and, like our fowls, only come forth at night. They subsist entirely on fruits, and have very powerful beaks, which are necessary to crack the tough nuts and reeds which form part of their food.

The approach to the cavern where they are found is along the bed of a river, in a valley celebrated for its beauty and the salubrity of its climate. The immediate entrance is surrounded by the most gorgeous tropical vegetation. The hill, into the depths of which it penetrates for upwards of half a mile, is clothed with trees of immense height. The mouth is a splendid arch upwards of seventy feet high; the river which flows from it has a fringe of vegetation along its banks, which gradually diminishes as the gloom increases.

The cave is so straight that the traveler can enter for some distance without being obliged to light his torch. As he proceeds over the somewhat rough ground which forms the bed of the river, he begins to hear from afar the hoarse cries of the guacharo birds; and when he has arrived at the dark parts of the cavern the noise is perfectly terrific, thousands of the birds uttering their piercing cries simultaneously.

These screams re-echo from the surrounding walls, and when it is remembered that they take place in pitchy darkness, it will be easy to understand the superstitious terrors which the Indians associate with the spot. At half a mile from the entrance the river forms a cascade, and beyond this the cavern slightly changes in direction. Nothing will persuade the timid Indians to advance further than this lonely spot.

Midsummer is the harvest time for the fat. The Indians enter the cave armed with long poles. The nests are attached to holes in the roof about sixty feet above their heads. They break these with the poles, and the young birds fall down and are instantly killed. Underneath their bodies is a layer of fat, which is cut off, and is the object sought. At the mouth of the cavern huts are erected with palm-leaves, and there, in pots of clay, the natives melt the fat which has been collected. This is known as the butter of the guacharo; it is so pure that it may be kept for upwards of a year without becoming rancid. At the convent of Caripe no other oil is ever used in the kitchen of the monks, and no other could answer their purpose so well.

THE HORNBILL FEEDING ITS YOUNG.

This shows what wonders abound in the bird-world, and what singular instincts and habits the feathered creation exhibits. In the Celebes Islands there is a remarkable bird called the hornbill. It has a curious nest. The female selects the hollow of a tree, and at the proper

time retires to it, where she makes a kind of couch of her own feathers, lays her eggs, hatches them and abides with her young until they are fully fledged. The male, meantime, plasters up the entrance to the nest, all except a narrow slit, adapted to the form of his beak, through which he feeds his mate. As a consequence, it is said, the voluntary prisoner grows quite fat, while the poor husband gets so lean and weak that any sudden change of temperature overcomes him. Not all the birds of remarkable construction and habits are confined to warm climates. The cold and desolate regions in the neighborhood of the poles are inhabited by numerous animals which rejoice in the climates of those frozen seas, and flourish under circumstances that would prove fatal to animals less well protected than they are. These animals are nearly all aquatic. The polar bear loves the ice and the icy cold water. His favorite prey, the seal, lives almost exclusively therein. The waters abound with different kinds of fish which make food for the seals, and for thousands of birds whose sole nourishment they are.

One of the most curious of these birds is called the king penguin. He is a most extraordinary creature, not only in appearance, but also in his mode of life. He is upwards of three feet high, and his plumage is short and waterproof. He has no wings, but instead of them small flappers that appear something like arms. His feet are webbed, and placed so far back that when standing he is upright like a man; whereas in ordinary birds the body is more or less horizontal. His flesh is rank and oily, and underneath the skin is a layer of fat, which serves to protect him from the cold.

This bird is found in great numbers in Macquarrie Island in the South Pacific Ocean, and a most interesting account of its habits has been given by a naturalist, who visited the locality. The number which inhabited the spot was enormous, but as thirty or forty thousand were continually landing, and the same number going to sea, it was impossible to arrive at an exact estimate. On shore they were arranged as regularly as a regiment of soldiers, and in as compact a manner; the young birds in one place, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth; and so strictly is the order kept, that if a bird of one class intrude itself into the ranks of another it is instantly ejected. The females hatch the eggs by keeping them close between their thighs, and if approached during the time of incubation, move away carrying the eggs with them. At this time the male bird goes to sea and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea, and bring home food for it. It soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting

places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts in order to encounter the very heavy sea met with at their landing place. They lay but one egg, of a whitish color, and twice the size of that of the domestic goose.

THE WONDERFUL PENGUINS AND OTHER ARCTIC BIRDS.

As the penguin has no wings, he is, of course, unable to fly; and as his movements on land are very awkward, the sea is the display of his powers. In swimming and diving he is unrivalled. Here his abortive wings are of great value to him; they act as fins or paddles which assist his hind feet in propelling him through the water. He sometimes,

when coming to the surface after a dive, leaps from the water into the air, and down again like a fish, for which, indeed, in this manœuvre he might easily be mistaken. Fish form his sole food and the food of his young, and his wonderful powers of diving are used in catching them.

Living on islands and in localities uninhabited by man, the penguins have not learned the dread of man which other animals exhibit. Illustrative of this point, Mr. Darwin gives us the following interesting account: One day, having placed myself between a penguin and the water, I was much amused by watching his habits; it was a brave bird, and till reaching the sea, regularly fought and drove me backwards. Nothing less than heavy blows would have stopped him; every inch he gained he firmly kept, standing close before me erect and determined. While thus opposed he continually rolled his head from side to side in a very odd manner. This bird is commonly called the jackass penguin, from its habits, while on shore, of throwing its head backwards and making a loud, strange noise, very like the braying of that animal; but while at sea and undisturbed, its note is very deep and solemn, and is often heard in the night-time. In diving, its little plumeless wings are used as fins, but on the land as front legs; when crawling (it may be said on four legs) through the tossocks or on the side of a grassy cliff, it moved so very quickly, that it might easily have been mistaken for a quadruped. The manner in which the young are fed is very curious. The old bird makes a great noise, between quacking and braying; after having thus chattered for a minute, it puts its head down and opens its mouth widely, into which the young one thrusts its beak and takes the food provided for it.

The variety of strange sounds uttered by various birds has been duly noted by ornithologists and bird-fanciers. Some are more teachable than others, and it is to these specimens that the epithet of "talking" is strictly applicable. The bullfinch learns to whistle tunes, to sing in parts and even pronounce words. We have from an authentic source an account of a talking canary. Its parents had formerly successfully reared many young ones, but three years previously they had hatched only one out of four eggs, which they immediately neglected by commencing the rebuilding of a nest upon the top of it. On this being discovered the unfledged and forsaken bird, all but dead, was taken away and placed in flannel by the fire, when, after much attention, it was restored and then brought up by hand. Thus treated, and away from all other birds, it became familiarised with those persons only who fed it; consequently its first singing notes were of a character totally different to those usual with the canary. Constantly being talked to, the bird, when about three months old, astonished its mis-

tress by repeating the endearing terms used in talking to it, such as "Kissie, kissie," with its significant sounds. This went on, and from time to time, the bird repeated other words, and for hours together, except during the moulting season, it astonished all who heard it by ringing the changes according to its own fancy, and as plainly as any human voice could articulate them, on several words. The usual singing notes of the bird were more of the character of the nightingale, mingled occasionaly with the sound of the dog-whistle used about the house. It whistled also very clearly the first bar of the tune entitled "America," and was evidently capable of high attainments.

Several birds approach the faculty of talking, mimicry and imitation of peculiar sounds. The Chinese starling, in captivity, is very teachable, imitating words, and even whistling tunes. The piping crow is

BIRDS THAT TALK—PARROTS.

named from its ready mimicry of other birds; and its imitation of the chuckling and cackling of a hen, and the crowing of a cock, is very perfect. The snowy-owl utters hideous cries, which resemble those of a man in deep distress. The natural cry of the Virginia eagle-owl resembles the half-suppressed screams of a person being suffocated or throttled. Parrots have presented remarkable instances of talking. One whose imitative talent was reckoned most extraordinary, was purchased for five hundred dollars, out of a West India ship at Bristol. This bird not only repeated a great number of sentences, and answered questions, but was able to whistle, with the greatest clearness and precision, one of the psalms, "The Banks of Dee," "God Save the Queen," and some other favorite songs, and if by chance it mistook a note, it would revert to the bar where the mistake occurred and finish the air

with great accuracy. This bird had received a refined education, and its breeding and bearing were clearly that of a polished bird of rank.

One of the most beautiful birds is the hoopoe, or lapwing, a native of Europe and northern Asia and Africa. It was known to Palestine, and the Jewish people looked upon it as a proscribed bird. It is rarely eaten except in countries where it is very abundant, for instance, Egypt, France and Spain. Marshy ground, ploughed land, wooded districts, especially such as are near the water, are its favorite haunts. Its crest is very elegant, the long feathers forming it being tipped with black.

The cuckoo is called so from its notes which, in sound, resemble its name. It arrives very early in the season, and hence is mentioned as the harbinger of spring. Unlike any other creature that flies, except our cow bird, it has a singular habit of depositing its eggs in the nests of other birds, such as sparrows, finches and larks, and leaving these birds to do its hatching for it, and take care of its young. The little cuckoos oust the other young ones from the nest, and make themselves quite at home. From this arises the German saying, "as ungrateful as a cuckoo." The males are more numerous than the females, and are bad tempered and quarrelsome.

THE BEAUTIFUL HOOPOE

There is a tribe of little birds that are often hunted by the great spider. He is always on the look-out for them. He can catch them as easily as he does the humming-birds. They are called fly-catchers. The fly-catcher is as beautiful as the humming-bird. Her body is so tiny that it is no bigger than the tip of your finger, and is as light almost as a feather. She can sport amongst the water-lilies without making a ripple. When she settles on the leaves of the sensitive plant, they do not shrink. Her weight can hardly be felt. A large, bright flower,

such as you meet with in the tropics, would make the little fly-catchers a tent, and afford them a safe and secure shelter.

But there is one species which is quite a giant among them, for it is nearly as large as a sparrow. The wings of the fly-catcher are of the most brilliant colors. Sometimes they are of a vivid green, and then she is called an emerald; or she will be compared to a ruby, or a diamond or any other precious gem. Thousands upon thousands of fly-catchers glisten and shine in parts of the forest where man could not live. He dare not brave the dangers he would meet with in these recesses. The air is unhealthy and full of poison. He would die of fever in a short space of time. There are venomous snakes, and poison-

THE UNGRATEFUL CUCKOO.

ous plants and savage beasts. But, in spite of all the dangers, the bright fly-catchers revel, and are in their glory, enjoying their forest home.

Among the decaying stems, and growing sometimes upon them, are the gayest and most fantastic flowers. The fly-catcher hovers over them. Her wings move so quickly you cannot see them. Her body all the time is still and motionless. Then her long bill is plunged into the depth of the flower, and an insect drawn out, or a sip of honey taken. The bird is a passionate little creature. If the flower has been emptied of its sweets, she goes into a rage. She will tear the bright petals to pieces, and scatter them to the winds. One of the fly-catchers is very fond of bees, as well as of honey; he is called the tyrant fly-catcher. He will take his stand on some twig or fence, near a row of bee-hives,

and watch for the bees to come in and out. Then, he will pounce down upon them, one after the other, and eat them up. If his nest is near the farm-yard, no eagle or hawk dare come and carry off the farmer's chickens. Out will dart the brave little fly-catcher and attack him fiercely. Sometimes he will mount on the eagle's back and peck him with great violence, and torment him so much, that he will be only too glad to get away. In other instances he will gather his companions, pursue the deadly viper, and in spite of its venomous tongue and efforts to escape, will worry it to death.

A HIGH-FLYER—THE KITE.

The American kite is a large bird with long wings and forked tail. The back wings and tail have large feathers, black in color, with a metallic lustre. The flight of the kite is exceedingly rapid and graceful. It is very shy, keeps on the wing during the larger part of the day, and at night remains perched on the highest trees. Its nest is made of sticks and leaves, and is commonly well secluded. It can soar to an immense height, but when on the ground its gait is very awkward.

The falcon is ranked among birds of prey, whose pugnacious disposition and rapacious habits distinguish them from most of the species to be found in the world of birds. It has a short, curved bill, with serrations which answer for teeth, wings wide at the base, or next to the body, with long, pointed tips, a broad, fan-like tail, and a high degree of muscular power. The toes are long and slender, with claws curved and sharp. Old sportsmen used the falcon in the chase, for while it is strong and courageous it is also docile, and will return to its master when called.

A singular creature, of which we have some knowledge in our country, is of such construction that it is difficult to determine where it ranks

in the animal kingdom. Yet, as it has wings and flies, we class it among the birds. The banyan tree, with its hundreds of spreading branches, gives shelter to man and animals. The beautiful green pigeon feeds and lives among its branches. And another creature, of a very different species from the pigeon, makes its home there. This Java bat is so large, that when its wings are spread, they measure six feet from the tip of one wing to that of the other. Thousands of these monstrous creatures shelter in the banyan tree all day. They hang from the branches by their claws, or else by the hook that is on their wings. They hang

THE LANNER FALCON.

with their heads downwards, fast asleep. If any one disturbs them, they utter sharp, shrill cries, and begin to struggle in a very awkward manner. Their claws are so sharp, and take such fast hold of the tree, that they cannot in a moment get loose. When evening comes, the bat wakes up, and begins to feel hungry. He unlooses himself from the branch and flies out, flapping his great leathern wings. Thousands of bats fly out at the same time, like a cloud. The mother bat will have her little one sticking to her breast, transporting it easily.

Insects and little birds, and mice and rats, are the bat's food. But he

has a great liking for ripe fruit, and is almost sure to go off to some garden and rob it. The bats settle on the trees, and commit frightful depredations. The poor man's garden is robbed as well as the rich man's. But the owner of the garden often takes his revenge. In the clear moonlight he can see the bats coming, flying at a slow, steady pace, and in a straight line. He loads his gun and takes his stand, and before the first bat has reached the tree there is a sharp report and a rattling sound, and down will drop the great bat, shot, perhaps, through the head. Others that venture near are apt to share the same fate.

THE IMMENSE JAVA BAT.

Other winged creatures are equally marvelous. The bittern is one. It belongs to the heron family, and frequents localities that are low and marshy, It is famous for the peculiar sound it makes at night, a kind of booming unlike that of any other creature. Three species of the bittern are found in our own country, and the bird is also common to different parts of Europe. Like the dove, it is mentioned in Scripture. Though not building, like the stork, on the tops of houses, it resorts to ruined structures. It seems to be a lonely, desolate bird, which will serve to explain some of the allusions of the sacred writers.

The thrush is the name of a fine little bird belonging to a family that contains some of the sweetest songsters in the world. It is met with in the eastern part of our country, its locality extending as far west as the Mississippi valley. It has a varied color, brown on the upper part of the body, brightest on the head, and pure white below, with yellow legs and brown bill. When it sings, its notes are not many, but they rise and fall in cadence, and are rich and mellow. Its food consists of insects, berries and other small fruits. It is a high flyer, and is strong on the wing.

THE CURIOUS BITTERN.

The earth has many treasures that man risks his life to get. There are pearls in the ocean, and there is gold in the mine, and coal deep in the pit where it would make your head giddy to look down. Man risks his life every day to get something or other that Nature has put almost out of his reach. But who would risk his life for a bird's nest? In China the rich people have a dainty dish, and it is made of birds' nests. No matter how hard they are to get, the Chinaman must have them for his table. They are sold in the market, and he buys them. The nests come from the island of Java. The coast of Java is very steep, and the cliffs have great holes or caves in them. The waves toss and roar about the caves, and numbers of birds fly in and out. You can hardly see them for the spray.

The bird has a long name; but as it belongs to the swallow tribe, we will call it a swallow. There seems no place for the nest to be built upon. But the bird has found one. She fastens it to the roof and sides of the cave. These are the nests that the Chinaman likes to eat. The men are let down from the top of the cliff by a rope-ladder, till they reach the cave. They find the floor covered, as it always is, with the

sea. They have to cling to the rough stones that stick out of the sides of the cave, and get a footing as they can. When they have got to the roof, they fasten ropes round the stones from side to side of the cave, and make a kind of rough bridge. On this bridge they have to stand while they pull down the nests.

THE SWEET-SINGING THRUSH.

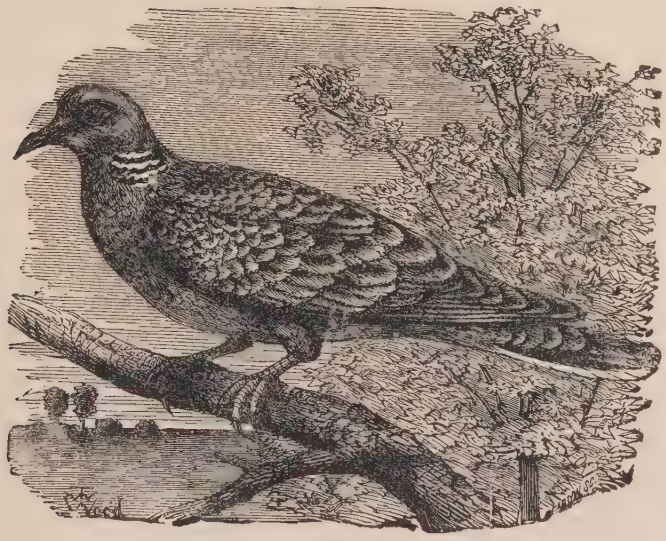
What danger these poor men are in! One false step and they would be lost. They dare not be let down the cliff, until they have offered up a prayer. They ask their gods to take care of them, and they place gifts on the tomb of the man who first found out the cave. The nests are thought so good to eat, because they are made of a kind of sea-weed. The bird swallows the sea-weed, and then brings it up in her mouth, quite soft and like pulp. She adds layer to layer until she has built her nest large enough. If the nests are old, they are not thought worth taking. They are like jelly and have no taste. But the Chinese cook puts in so many spices and other things, that he makes them very nice, indeed. The people of Japan know that the birds' nests are only made of sea-weed. They get the same sea-weed, and beat it soft, and boil it to a jelly. Then they make mock birds' nests, and bring them to the market to sell as a luxury.

THE TURTLE DOVE.

One of the most interesting species of birds is comprised in what may be called the dove family. The turtle dove is a general name given to several small pigeons. They are not so large as the ordinary domestic pigeon, have a smaller

bill, longer toes, and a wedge-shaped tail. They feed on the ground, and roost in trees. More than a dozen species are to be found in Europe, India, and Africa. They are migratory, and are commonly seen in flocks of about twenty. A peculiar interest belongs to the turtle dove from the fact that it was employed in the Jewish sacrifices. From its habit of pairing for life, and its fidelity to its mate, it was a symbol of purity, and an appropriate offering.

One of the largest varieties of pigeons is the ring dove, measuring sixteen or seventeen inches in length. It is an arboreal species, perching on trees, and making its nest among the branches. It produces two eggs and then rears its little ones, doing this usually twice a year. The color of its breast is a reddish purple; the sides of the neck are a



THE RING DOVE.

glossy green, flanked by a patch of white, which nearly forms a collar. It is found in even severe climates, and sometimes migrates to escape extreme cold, being sensitive to the various changes of the seasons.

Many tropical birds are marvels in their way, and some of the forests in the islands of the sea are the home of feathered tribes which are an amazement to the traveler. Lories display their vivid plumage on the branches above his head; gleaming kingfishers dart like lightning into the current of the slow stream that creeps by his side; his ears are filled with the noisy cries of cockatoos and parroquets, rising in shrillest clamor above the more musical strains of the few song-birds that inhabit the green recesses.

242 WONDERFUL WALKING LEAF.

CHAPTER VIII.

WONDERS OF THE INSECT WORLD.

Extraordinary Strength of Insects—Their Jumping Power—The Sprightly Flea—The White Ant—Ants' Intelligence—Insects that Keep a Dairy—The Brilliant Lantern-Fly—The Wonderful Bees—The Venomous Scorpion—The Ruinous Weevil—A Fly's Mouth—Butterfly Wonders—The Palmer Worm—The Painted Lady—A Singular Fly-Trap—The Sagacious Spider—Doctor Livingstone Poisoned—The Bloated Chego—Educated Fleas—The Mail-Clad Beetle—Destructive Locusts—The Enterprising Silkworm—A Great "Bore"—The Poppy-Cutter—Poisonous Insects—The Gad-Fly—The Leaf Insect—Insects Counterfeiting Death.

MANY people have observed how out of proportion a jump of a flea is to its size. A flea is not more than an eighth of an inch in length, and it jumps a yard; in proportion a lion ought to jump two-thirds of a mile. Pliny shows that the weights carried by ants appear exceedingly great when they are compared with the size of these indefatigable laborers. The strength of these insects is still more striking, when one considers the edifices they are able to construct, and the devastations they occasion. The white ant constructs habitations many yards in height, which are so firmly and solidly built, that the buffaloes are able to mount them, and use them as observatories; they are made of particles of wood joined together by a gummy substance, and are able to resist even the force of a hurricane. Man could scarcely build a more solid edifice.

There is another circumstance which is worth being noted. Man is proud of his works; but what are they, after all, in comparison with those of the ant, taking the relative heights into consideration? The largest pyramid in Egypt is one hundred and forty-six yards high, that is, about ninety times the average height of man; whereas, the nests of the white ants are a thousand times the height of the insects which construct them. Their habitations are thus twelve times higher than the largest specimen of architecture raised by human hands. We are, therefore, far beneath these little insects, as far as strength and the spirit of working go. The destructive power of these creatures, so insignificant in appearance, is still more surprising. During the spring of a single year they can effect the ruin of a house by destroying the beams and planks. It is well known what destruction is caused when a swarm of locusts alight in a cultivated field; and it is certain that even their

larvæ do as severe injury as the perfect insect. All this sufficiently proves the destructive capabilities of these little animals, which we are accustomed to despise.

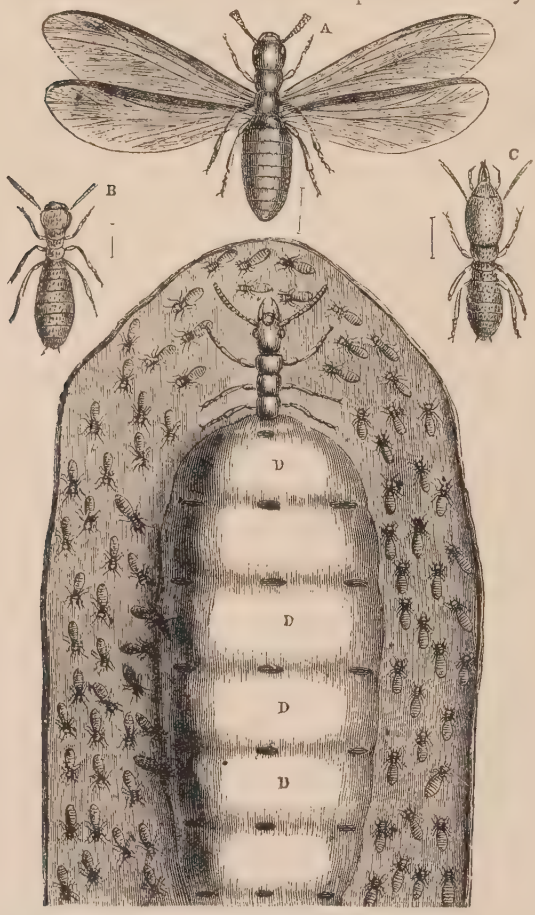
The average weight of man being one hundred and forty-two pounds, and his power of traction being one hundred and twenty-four pounds, the proportion of the weight he can draw to the weight of his body is only as eighty-seven to one hundred. With the horse, the proportion is not more than sixty-seven to one hundred, a horse one thousand three hundred and fifty pounds in weight only drawing about nine hundred pounds. The horse, therefore, can draw little more than half his own weight, and a man cannot draw the weight of his own body. This is a very poor result, if compared with the strength of the cockchafer, or may-bug. This insect, in fact, possesses a power of traction equal to more than fourteen times its own weight. If you amuse yourself with the children's game of making a cockchafer draw small cargoes of stones, you will be surprised at the great weight which this insignificant-looking animal is able to manage. The bee can draw twenty times the weight of its body; a beetle forty-two times its own weight. From this it follows that if the horse possessed the same strength as this last insect, or if the insect were the size of a horse, either of them would be able to draw one hundred and fifty-five thousand pounds. The proportion between the muscular strength of insects and the dimensions of their bodies, would not appear to be on account of their muscles being more numerous than those of vertebrate animals, but on account of greater intrinsic energy and muscular activity. The articulations of insects may be considered as solid cases which envelop the muscles, and the thickness of these cases appears to decrease in a singular manner according to the size of the creature. The relative bulk of the muscles being less in the smaller species than in the larger, it is necessary to explain the superior relative strength of the former by supposing them to possess a greater amount of vital energy.

These astonishing phenomena will perhaps be better understood if we consider the obstacles which insects have to overcome to satisfy their wants, to seek their food and to defend themselves against their enemies. To meet these requirements they are marvelously constructed for both labor and warfare, and their strength is superior to that displayed by all other animals. It is also much greater than that of the machines we construct to replace manual labor. They represent strength itself. God's workmen are infinitely more powerful than those invented by the genius of man, which we call machines. A close observer relates the following anecdote of a three-horned beetle, which is not larger than the ordinary English stag-beetle; this insect astonished

me by a proof of its vast strength of body. When it was first brought to me, having no box immediately at hand, I was at a loss where to put it until I could kill it; but a quart bottle of milk being on the table, I clapped the beetle for the present under that, the hollow at the bottom allowing him room to stand upright. Presently, to my surprise, the bottle began to move slowly, and glide along the smooth table, propelled by the muscular power of the imprisoned insect, and continued for some time to perambulate the surface, to the astonishment of all who witnessed it. The weight of the bottle and its contents could not have been less than three pounds and a half, while that of the beetle was about half an ounce; so that it readily moved a weight one hundred and twelve times exceeding its own. A better notion than figures can convey will be obtained of this feat by supposing a lad of fifteen to be imprisoned under the great bell of St. Pauls, which weighs twelve thousand pounds, and to move it to and fro upon a smooth pavement by pushing within.

The white ants, already referred to, are met with in the savannahs of North America, in Guyana, in Africa, in New Holland and even in Europe, whither they have been imported. One traveler relates that in Guyana, he saw the negroes besieging certain strange buildings, which he calls ant-hills. They dared not attack them, except from a distance, and with fire-arms, although they had taken the precaution of digging all around them a little trench filled with water, in which the besieged would be drowned if they made a sortie. These were the white ants' nests. The workers are a fifth of an inch long, the body soft and of an extreme delicacy, but the sharp mendibles or jaws capable of attacking the hardest bodies. The soldiers are twice as long, and weigh as much as fifteen workers, and may be distinguished by their enormous horned head, armed with sharp pincers. The male weighs as much as thirty workers, and attains to a length of nearly four-fifths of an inch. But another female leaves all these dimensions far behind. She attains to six inches in length, and weighs as much as thirty thousand workers. By a hideous contrast, the head alone does not increase in size. She is always motionless and captive in her cell, entirely occupied in laying. Her fecundity surpasses all bounds: sixty eggs a minute, more than eighty thousand a day. This prodigious laying goes on during the whole of the year. The larger she is, the more fruitful, the more inexhaustible, this terrible insect-mother seems to be the more adored by the fanatical rabble. She seems to be their beau ideal, their poetry, their enthusiasm. If you carry away with any rubbish a portion of their city, you see them instantly set to work at the breach to build an arch which may protect the venerated head of the mother, to recon-

struct her royal cell, which will become (if there are sufficient materials) the centre, the base of the restored city. If all other species did not combine to destroy them, this truly prodigious mother would make them masters of the world, and its only inhabitants. The fish alone would be left; but insects would perish. It suffices to be remembered that the mother-bee does not produce in a year what the female white ant can produce in a day. By her they would be enabled to devour everything; but they are weak and tasty, and so everything devours them. In fact, birds are very greedy after termites; poultry destroy immense quantities of them. Other ants give chase to them and eat them by legions. The negroes in Southern Africa cannot be sated with them. They gather such as have fallen into the water, and roast them like coffee; thus prepared, they eat them by handfuls, and find them delicious. The Indians smoke the termites' nests, and catch those that have wings. They knead them up with flour, and make a sort of cake of them. Travelers, moreover, all agree in speaking of them as very nice food, comparing their flavor to that of marrow or of a sugared cream, and of excellent quality.



THE MONSTROUS WHITE ANT MOTHER.
Male (A), Worker (B), Soldier (C).

When Doctor Franklin was in Paris, as he sat quietly and alone at his breakfast one morning, he saw a number of black ants busy with the contents of the sugar-bowl. He drove them away, but they returned. Again he dispersed them, but in a few minutes they were seen climbing from lump to lump, as if nothing had happened. To try their

ingenuity, he had the sugar-bowl suspended by a string from the ceiling. They endeavored to reach it by standing on each other's backs; several mounted in that manner and reached upwards, but in vain; the chain of ants fell down as fast as it was raised. After repeated attempts they went away, and he supposed they had given up the matter; but presently he saw them descending the string, and dropping down upon the lumps of sugar. They had scaled the walls, traversed the ceiling and discovered another road to the treasure.

Like our common bee, ants live in large communities. The ant-hill, the residence of these communities, is a wonderful construction, made of earth. It is about the form and size of a washing-basin turned upside-down, and contains within it innumerable chambers and galleries, made by the energy and industry of its little inhabitants. If a small piece of this house be broken, and the interior examined, it presents a scene of wondrous activity. Some ants rush hither and thither; some seize the eggs which have been exposed, and hurry with them to a place of safety; others apply themselves to repairing the breach. While thus engaged, the ants, on meeting, are often observed to stop, and, touching each other with their feelers, apparently have the power of communicating their ideas, and agreeing as to their work.

INSECTS THAT KEEP COWS.

Wonderful are the observations which have been made about these little animals; not the least of them is the discovery that some ants keep what may be called milch cattle. There is a small insect inhabiting trees, and the leaves and stems of plants. It is well known in green-houses, where its presence is greatly detested by gardeners, who use all means in their power to get rid of it. This little insect, called the aphis, is the milch cow to which the ants are indebted to for an important part of their sustenance. At certain times of the year the plants tenanted by the aphis are frequented by multitudes of ants, their object being to obtain a fluid which is secreted in the body of the aphis. This fluid, scarcely inferior to honey in sweetness, comes from them in drops, and is eagerly sought by the ants. The aphis, with its mouth fastened into the bark of the tree, is continually drinking in the sap, which, after having passed through its body, comes out as this sweet fluid. An ant is seen to caress an aphis with its feelers, and immediately the latter yields a drop of its honey, which is greedily swallowed by the ant.

More than this, by common consent it appears to be arranged that the aphides on a particular branch shall belong to the ants of a particular nest, and any other ant intruding on their preserves is treated with summary justice. The ants love their useful allies, will defend them

BIRTH OF THE WONDERFUL LANTERN-FLY.

from aggression, and may be seen to carry them about in their mouths. Some kinds of ants treat their cattle in a still more curious way—they keep them in their own nest and supply them with their neeessary food. When the aphis lays eggs the ants undertake the charge of them, bringing them out to the sun, and moistening them with their tongues, thus using all means to increase their stock of cattle by successfully hatching the eggs. Such valuable property as the aphides are naturally tempts the attacks of robbers. Tenants of a neighboring hill often make a raid with a view to capture them, and their owners fight for them with valor, knowing as they do how essential to the life of the colony is their stock of milch cattle, which must therefore be defended.

INSECTS THAT SHINE IN THE DARK.

Equally marvelous is the tribe of insects that have luminous properties. One of the most beautiful features of the savannahs in the tropics is the fire-fly. When the stars shine forth, the broad grassy meadow becomes illuminated with a thousand glittering lamps, almost as if it reflected the vault of heaven from its surface; and the thicket and the forests are often full of their tiny but brilliant lights, flitting from flower to flower through the air, or shedding a mild refulgence over the surrounding foliage. It is said that the South American Indians, when they travel at night, attach several of them to their hands and feet, instead of carrying a lantern, whilst their wives use them for candles in the performance of their evening household duties.

Many of the Indian tribes regard them with quite a childish pleasure, not only using them to adorn the hair of the girls, but decorating their holiday attire with them, as well as the trappings of their horses, for which purposes they often collect large numbers on feast days, when they amuse themselves in quite a theatrical fashion, dressing in the most fantastic costumes, with masks and skins, to represent various animals. There are a great many species of fire-fly known—perhaps more than a hundred—most of them indigenous to America, and distributed over the whole territory from New England to Chili.

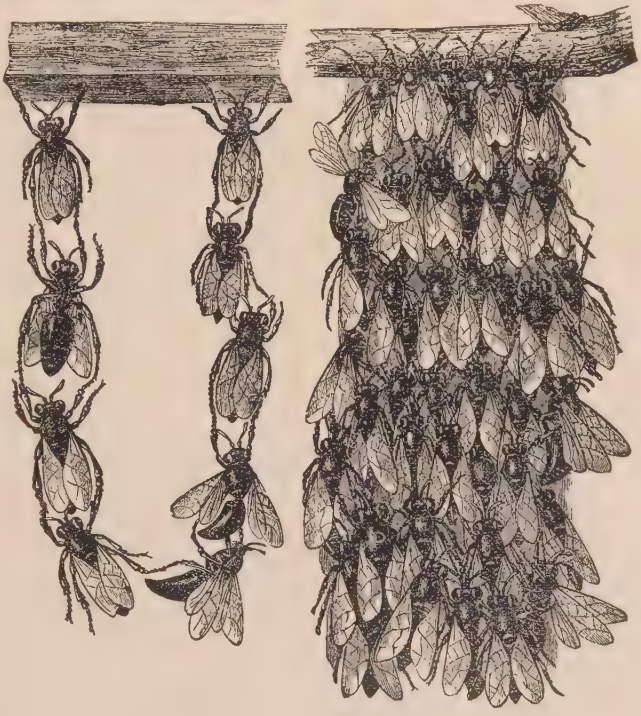
From time immemorial the nature and habits of bees have formed a study for the curious, and an endless occasion for wonder. The female, or queen, is smaller than the male, and has a longer body than the working bees, and the wings, shorter in proportion, cover only the half of its body, whereas with the other bees they cover it entirely. The only part she has to play is that of laying eggs, and so she has no palettes and brushes. The sovereign is, as suits her supreme rank, exempted from all work. She is always escorted by a certain number of working bees, who brush her, lick her, present honey to her with their trunks, save her every kind of fatigue, and compose a train worthy of her emi-

nine majesty. One very remarkable fact is that only one queen lives in each hive. Perfect sovereign of this tiny state, she rules over a people of some thousands of workers. It is not rare to find twenty-thousand working bees in a hive, and all submissively obey their sovereign. The number of males is scarcely one-tenth part of that of the working bees; and they only live about three months. The workers represent the active life of the community.

The exterior of a hive gives the best idea of this people, essentially laborious. From sunrise to sunset, all is movement, diligence, bustle; it is an incessant series of goings and comings, of various operations which begin, continue, and end, to be recommenced. Hundreds of bees arrive from the fields, laden with materials and provisions; others cross them and go in their turn into the country. Here, cautious sentinels scrutinize every fresh arrival; there, purveyors, in a hurry to be back at work again, stop at the entrance to the hive, where other bees unload them of their burdens; elsewhere it is a working bee which engages in a hand-to-hand encounter with a rash stranger; further on the surveyors of the hive clear it of everything which might interfere with the traffic or be prejudicial to health; at another point the workers are occupied in drawing out the dead body of one of their companions; all the outlets are besieged by a crowd of bees coming in and going out, the doors hardly sufficing for this hurrying, busy multitude. All appears disorder and confusion at the approaches to the hive, but this tumult is only so in appearance; an admirable order presides over this emulation in their work, which is the distinctive feature in bees. A very simple calculation may serve to give us an idea of this prodigous activity. The opening of a well-stocked hive gives passage to one hundred bees a minute, which makes, from five o'clock in the morning till seven o'clock in the evening, eighty thousand re-entrances, or four excursions for each bee, in a population of twenty thousand workers.

Let us now follow their occupations from the moment in which they establish themselves in a hive. The workers begin by stopping up all the openings except one door, which is always to remain open. A certain number set out to look for a resinous and sweet-scented substance, known under the name of propolis, which is destined to cover the inner surface of the hive, as its name shows, which is derived from a Greek word signifying outskirts, or suburb. This gum is viscous and very adherent. The bee works it up into balls, and carries it in this form to the hive, where other laborers take possession of it. They seize the pellet with their mandibles, or jaws, and apply it to cracks which they have to make air-tight. They use the propolis for another purpose still, which deserves to be mentioned.

It happens, sometimes, that an enemy penetrates into their hive, and that the bees are not strong enough to cast this intruder out of their dwelling. What do they do? As soon as they have discovered the invasion of their domicile, they set upon the impudent intruder and sting him to death. But how can they drag out the dead body, which is often very heavy, such, for instance, as a slug? On the other hand, it would be dangerous to abandon its carcass in the midst of the hive. A Roman Emperor said that the dead bodies of our enemies always smelt good. This is not the opinion of the bees. They know that if they abandon the carcass in the hive it would infect the place, to the great danger of their health. They therefore embalm it. They encase it in propolis, which preserves it from putrefaction. It is said that the art of embalming was practised for the first time by the ancient Egyptians. It is an error. The first inventors of this art were ingenious bees.



WONDERFUL CLUSTER OF BEES.

If, instead of a slug, it is a snail whose evil genius has conducted it into the interior of a beehive, the proceeding is more simple. The moment he has received one sting, the snail retires under the protecting roof of his movable house. The bees thereupon at once wall him in by closing the opening to his shell with this material. The shell is then cemented to the floor of the hive, and the house of the poor mollusk becomes its tomb, and remains thus in the midst of the hive, as a sort of decorative tumulus. When the sides of the hive are well closed, the bees lay the foundations of their cells. It was not formerly so easy to observe the details of the work

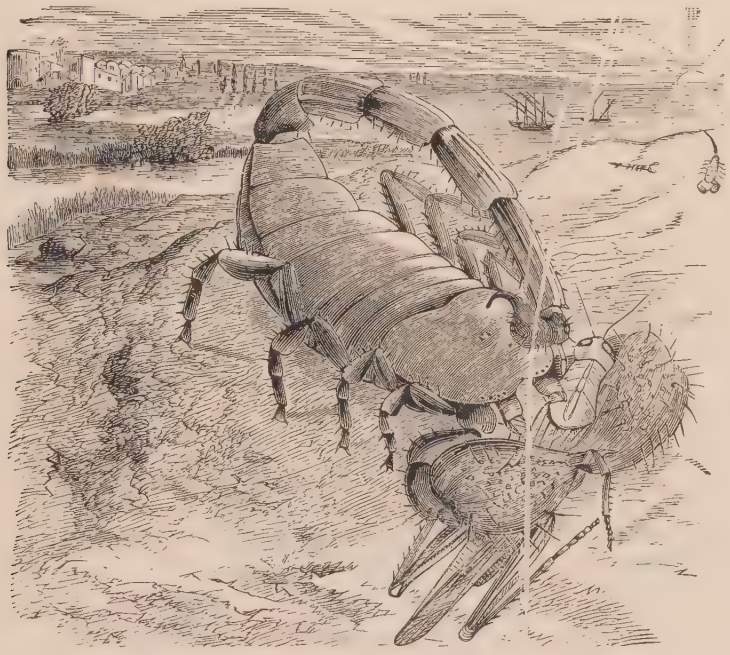
done by the bees as it is at the present day; for these insects, once in their hives, have a great aversion to the light. If they are put into a glazed hive, their first care is to shut up all the windows, either by plastering them over with propolis, or by forming, by means of the well-marshalled battalion of working bees, a sort of living curtain.

When the working bees begin to construct their hives they divide the work among themselves. A first detachment is employed to gather the wax, which is the building stone of our little architects. It is easy to perceive the little plates of wax by slightly raising the last rings of the bee's body. The working bees suspend themselves from the roof of the hive in such a manner as to form festoons. The first clings to the roof with his front legs, the second hooks himself on to the hind legs of the first, and so on. They in this manner form chains, fixed by the two ends to the roof, which serve as a bridge or ladder to the bees which join this assembly. The result of all this is at last a cluster or swarm of bees which hangs down to the bottom of the hive. In this attitude they remain at first motionless, waiting till the honey in their stomachs is changed into wax. When the wax is sufficiently elaborated in its organs, one of them detaches itself from the group of which it forms a part. It takes between its legs one of the flakes of wax adhering to the rings of its body, kneads it with its mandibles, moistens it with its saliva, and gives it the appearance of a soft filament, which it sticks on to a projecting point of the roof. To this first layer it adds others, till it has exhausted all its wax. Then it leaves its post, and returns to the fields; another worker—another mason, as they are sometimes called—succeeds it, and continues the laying of the foundations. Presently shapeless blocks of wax hang down from the roof. It is in these blocks that other workers, with their mandibles, hollow out and form the first cells. While the workers continue to prolong the foundation wall, and whilst the first cells are being shaped, new ones are roughly sketched out or rough-hewn, and the work advances with a marvelous rapidity.

The honeycombs are the result of two layers of cells placed back to back, arranged in such a way that the bases of the one become the bases of the other, the base of each little cell being formed by the union of the bases of three opposite cells. The bees begin by forming the base of the cell; they then add the six sides, or walls, which are to complete the hexagonal cup. At the same time others set to work on the opposite side of the comb, and construct little cells back to back with the cells of the front surface. They do not finish them off at once. New workers succeed those who merely mark out the work, being occupied in planing down the rough-hewn-cells, and in reducing

the walls to the desired thickness. This work is accomplished with an incredible celerity, for the bees can build as many as four thousand cells in twenty-four hours. There is very good reason for the hexagonal form being adopted by the bees in constructing their cells, as it involves a question of economy, which these insects have solved in their most admirable manner.

The bee is a producer, a benefit to man, who enjoys its labor and pays no price. There are insects, however, whose sole mission appears to be destruction. This may be said of the scorpion. The scorpion



THE DEADLY SCORPION.

is one of the largest and most malignant of the insect tribe. It somewhat resembles the lobster in general appearance, but is much more hideous. It is from two to four inches in length. It lives upon other insects, but kills and devours its own species also. It frequents dry and hot places, and lies under stones and in the crevices of old ruins. The bite of the scorpion is generally fatal, but not always so. The poison is injected by means of a sharp, curved sting at the end of the six-jointed tail. It occasions great pain, inflammation, and hardness, with alternate chills and burning, and fortunate is the one who, having been stung, recovers from the dangerous wound.

The tribe of weevils must also be classed among destructive agents. One may know them by their head prolonged into a snout or trunk, by their rudimentary mouth, and by their elbowed antennæ, or horns. About twenty thousand species are said to exist. They feed on vegetables. Their larvæ are soft, whitish worms, without legs, with very small heads, and live in the interior of the stalks or seeds of plants, often occasioning enormous damage. They are one of the plagues of agriculture. Each of our dry vegetables, each variety of our cereals, has in this immense family its particular enemy. The pea weevil, which is brown with white spots, comes out of the pea at the end of the summer. The female lays her eggs on peas which are ripe, and still standing, in which the larva scoops out a habitation, and then makes its exit by a circular hole. It remains at rest all the winter, and is not hatched till towards the following spring. The bean weevil marks each bean with many black spots. The wheat weevil, of a darkish brown, lays its eggs on the grains, of which the larvæ then eat the interior. A host of ways of getting rid of the weevil have been proposed. The best means is to store grain properly, and to keep the heap well aired, driving out the pest by this simple process.

THE WEEVIL UNDEVELOPED AND FULL GROWN.

All vegetables, the vine, fruit trees, the ash, pines, as well as grains, are eaten by some weevil or other. One species takes the precaution of cutting half through the young stems and the stalks of the buds of the pine, so that the sap flows only with difficulty into the withered organ, and cannot suffocate the young larvæ. Other weevils hollow out galleries between the wood and the bark of different trees, when in the larva state, and devour the leaves in the adult state. They are sometimes so numerous in the forests that the trees are tattooed all over by the larvæ. Whole forests of oaks, aged from thirty to forty years, have been ruined by their ravages. One species, hairy, and of a tawny color, are a terrible plague to pine forests. In one season in

the Forest of Hartz, one million five hundred thousand trees were destroyed by these insects. Often have the priests implored in the churches the Divine clemency, to put an end to the devastations made by them.

One genus has the antennæ very long; they exceed in some of the species two or three times the length of the body. The larvæ are large whitish worms, which live in the wood of trees, the adult insects frequenting flowers and rotten trees. In the month of June one meets them on the oaks, whose larva scoops out its galleries in the interior of the tree, and often occasions much damage.

Another tribe comprises what are called lady-birds. These little globular, smooth insects, red or yellow, with black spots, are very useful to us, for they clear the trees of other mischievous insects. Their larvæ make use of their front legs to carry their prey to their mouths. When danger threatens a lady-bird it hides its feet under its body, and remains sticking to the stem of the bush. If you touch it, it allows itself to fall to the ground, but sometimes opens its wings and flies off rapidly. It also exudes from the articulations of its body a yellow liquid, of a pungent and disagreeable odor. This is the only means of defence possessed by this little inoffensive and withal useful being.

AN EXTRAORDINARY MOUTH.

The weevil is an out-door insect. There are insects that boldly step inside the house, and are familiar objects, yet of most marvelous construction. The eye of a common fly has four thousand lenses, or reflectors, each of use in the matter of vision, yet no part of fly structure is more wonderful than the mouth. Watch a common fly alight on a piece of sugar. From the under surface of the head apparently is unfolded a long organ looking like an additional leg; and with this the fly scrapes the sugar, licks up the cream, spoliates the jam, and effects destruction in other and varied ways. To understand what the organ is, let us briefly glance at the typical structure of the insect mouth. Four sets of organs or appendages compose the mouth. There is first an upper lip, then a pair of large jaws—forming a tube or tongue in butterflies—and last of all a lower lip. In a beetle the chief mouth organs are the greater and lesser jaws, while in a bee or wasp the jaws are also well developed for the work of the hive, but the under lip forms a tongue, wherewith the bee sucks up honey from the flowers. Now in the fly the mouth parts are of a modified nature. Speaking generally, the jaws are represented by small bristle-like organs, and the upper lip is developed; but it is the labium, or under lip, which comes to the front in the development of the fly's mouth. Here it forms, as in the bee's, the chief organ of nutrition. It is the

under lip which we see unfolded from beneath the head when the fly attacks the sugar. And when we place this organ beneath the microscope, we can readily discover the secret of its service.

The tongue, as we may term the under lip, consists of a stalk, highly movable and muscular, at the end of which a couple of broad leaves expand out from the middle to form a sucker-like organ, beautifully adapted for licking up fluids, and for scratching solid matters also. This fan-like end is supported on a firm tubular frame work, acting as a set of springs to open and shut the fans, while the microscope shows us that this structure is really like a file or rasp in its nature. We can understand then, readily enough, how such a muscular organ can be used for the purposes of fly nourishment. When after a summer of flies, the morocco covers of our books and the finely polished surface of our furniture are scratched and eroded, we can readily appreciate the cause of the damage. With this it wages war even on ourselves. For, as a famous authority on insects remarks, it is by its means that the fly teases us in the heat of summer, when it alights on the hand or face to sip the perspiration as it exudes from and is condensed upon the skin, thus causing an irritation which is anything but pleasant.

THE WONDERS OF BUTTERFLY LIFE.

Some of the old workers in stained glass who made the grand colored windows for ancient cathedrals and monasteries, were fond of producing figures of a gaudy butterfly, when they wished to represent the idea of the resurrection from the dead. The butterfly, with its expanded wings, gay colors and lively flight, was to them, as it is to us, a proof that beauty could follow hideousness in the ordinary course of nature, and it was an emblem that the immortal spirit would cast off the gross body of our senses and animal mind. What a difference there is between a green and yellow caterpillar, covered with bunches of hair here and there, and not smelling over nice, that gorges cabbage-leaves hour after hour and day after day, and the delicate white butterfly, with its black spot on its large wings, its long proboscis, which rarely is used, its silky body, pretty, long horns and hesitating flight! The caterpillar becomes a chrysalis, and this the perfect insect. To the eye there is a decided change of form—a metamorphosis; but to the anatomist there are proofs of internal and external changes in the construction of the tissues and organs that are most wonderful.